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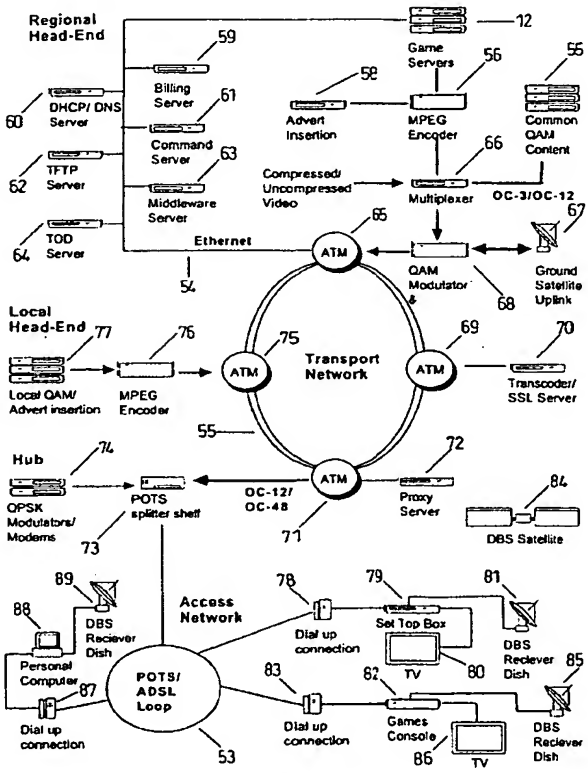

(57) Abstract: A video games system for digital television that includes a Games Servers (12), an MPEG Encoder (56) for encoding games provided by the Games Server (12) and a transport network connecting the users terminals to the Games Server (12) that may be used to transmit video games stored remotely via a in-band digital transmission channel or out-of-band forward data channel to users terminal may include a Set top box (79), Games Console (82), PC (88) which is operable to receive and render a game.

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IMPROVEMENTS TO INTERACTIVE TV GAMES SYSTEM

The invention described within the application relates to a video games system for digital Satellite, Cable and Terrestrial TV subscribers equipped with a Games Consoles, PC or Set Top Box (STB). In particular, this invention relates to a video games system for subscribers with the means for receiving Cable, Satellite or Terrestrial TV programs that combines digital transmission channels (DTC), video streaming and server technology that provides a scalable and interactive delivery of games to Games Consoles, STBs and PCs.

An objective of the present invention is to provide an interactive TV games system that allows TV viewers equipped with a games console, PC or STB to access 32-bit or higher games at anytime from a DTC without the need for an internet connection, CD, DVD or hard disc.

DVDs and CDs on Games Consoles and PC's are well known and provide a useful way to play sophisticated 3D games that require large amounts of capacity. Although this provides a useful way of playing games, the user is still required to buy a CD or DVD from a third party retailer. This limits the user's accessibility to games and significantly reduces the profit margins of Games publishers and developers alike. This is disadvantageous.

Gaming on Games Consoles and PCs is constrained by many factors including the hardware capabilities and legacy systems that dramatically reduce the level of interactivity and accessibility to games. Currently games can be acquired through downloading a game from the Internet or purchasing a CD or DVD from a retailer.

Broadband presents a new opportunity in delivery of games through the Internet at high speed, however there are a number of logistical issues with current and future broadband offerings including scalability and costs. Current broadband systems require every user to have an individual broadband connection, which means that with the present solutions every user would each require a 3Mb/s broadband connection to the home. This is disadvantageous.

Currently only 2% of users who have a Games Console in the UK have access to broadband, which costs an average £30 per month to each user, whereas in comparison over 9m viewers in the UK alone have access to digital TV, which costs an average £15 per month. Worldwide there are already over 100m digital TV subscribers who have access to digital satellite, cable or terrestrial TV, which is increasing rapidly.

Today the current Worldwide installed base of Games Consoles is equal to 100 million users. To provide such a service through an Internet based solution to an installed base of this scale would place significant costs on user and publishers that would be equal if not greater than the cost of distributing games on CD/DVD. This is disadvantageous.

An objective of the present invention is to provide a video games distribution solution for Games Consoles and PCs based on existing cable, satellite and terrestrial TV operator architectures, which would enable users to access 3D and 2D games through a TV channel. This is achieved by utilising the out-band forward data channel (FDC) and in-band Forward Path bandwidth capacity of a digital transmission channel (DTC) to provide game data to a Games Console, PC or Set Top Box (STB).

A further objective of the present invention is to provide a multi-platform games distribution system for games consoles and PCs which enables users to access games directly through a TV channel by utilising the out-of-band FDC and in-band forward path bandwidth capacity of a digital transmission channel (DTC).

Coupled with a scalable, high-performance server system optimised for the delivery of games and based on proven real-time technology the games distribution system aims to provide a significant improvement over proprietary and constrained broadband Internet systems. Through powerful yet simple user interfaces hundreds of thousand if not millions of PC and Games Consoles users could directly access up to seventy games per DTC without the need for an internet broadband or ADSL connection as will be described. This is advantageous.

An objective of the present invention is to provide new enhanced TV services to Games Console, PC users that enhances the gaming experience and provides unique user interfaces that are accessible from a DTC for accessing single player and multi-player networked games.

A yet further objective of the present invention is to integrate the use of broadcast video provided over an in-band DTC that may be utilised within a game to enhance the graphic quality of the game. A yet further objective of the present invention is to integrate the use of TV channels and programs with games to provide a unique experience and delivery of games that is no longer constrained by accessibility and which enhances the gaming experience.

A further objective of the present invention is to enhance gaming experience on a STB, Games Console and PC by providing remote co processing and assistance graphic processing that enables more complex 3D graphics than supported by a STB, Games Console or PC to be rendered within a game. This is advantageous.

According to the present invention the games system consists of a software architecture, which includes native applications that reside on Games Servers, middleware applications that reside on Middleware and Proxy Servers and resident applications that reside on Games Consoles, PCs and STB.

The software architecture described facilitates the means of providing game data over a DTC or FDC by a digital Satellite, Terrestrial or Cable TV provider. The software architecture also provides the means enabling the Games System to utilise existing

communication paths and infrastructure of Cable, Terrestrial and Satellite TV providers as will be described.

According to present invention within a subscribers premises there may be a number of devices, which may be used to access data of games provided by the Games Server over the Cable, Terrestrial or Satellite transmissions. These devices may include a Set top Box (STB), a Personnel Computer (PC) or a Game Console.

A PC typically consists of a Central Processor Unit, RAM, DRAM, SDRAM, EEPROM, DVD Drive, Graphics Accelerator Card, Hard Disc, PS2 ports, Modem/receiver, MPEG decoder and an Operating System (O/S).

A STB typically consists of a Central Processor Unit, RAM, Flash memory, EEPROM, Graphics Processor, USB ports, Modem/receiver, MPEG decoder and an Operating System (O/S).

A Games Console typically consists of a Central Processor Unit, RAM, DRAM, SDRAM, EEPROM, DVD Drive, Graphics Accelerator Card, USB ports, Modem/receiver, MPEG-2 decoder and an Operating System (O/S).

According to the present invention a Modem within the subscribers Games Console, PC or STB provides the interactive TCP/IP transport necessary to transmit and receive data from the TV operators network. The modem may be a Cable modem, a Satellite Modem or a Terrestrial modem depending on the TV provider. Typically a cable modem may be interfaced with the TV network via two-way hybrid fiber optic cable, whereas a Satellite modem or terrestrial modem are interfaced via a dial-up interface over DSL/POTs cables.

According to yet a further aspect of the present invention the modem may form part of a receiver that may be based on Multimedia Cable Network Systems (MCNS) on Digital Video Broadcasting (DVB) specifications. In this way the subscribers STB, Games Console or PC may be interfaced with a Direct Broadcast Satellite (DBS) Receiver Dish or UHF/VHF Terrestrial Antenna from which data transmitted by the Games Server may be retrieved as will be described.

It will be appreciated that various Modems/receivers models may be used to interface the subscribers STB, Games Console or PC with the TV network provider including those developed by PACE Microsystems, Broadcom or Motorola.

According to yet a further aspect of the present invention the Game System is operable to work with various cable modem specifications for data communication over cable, satellite and terrestrial TV including those used by NTL and Telewest such as Multimedia Cable Network System (MCNS) a US standard. It will be appreciated that there are various other modem specifications which cloud be used for providing games including Digital Video Broadcasting (DVB) a European standard.

According to yet a further aspect of the present invention software may be provided on the STB, Games Console or PC that enables the device to be interfaced with MCNS or DVB based Cable modems. Transcoding servers are operable to convert MCNS and DVB data streams to IP based packets, which are then transmitted to Game Server.

It will be appreciated that within the subsystem components of a STB, Games console or PC it is possible to reconfigure the resident operating system and native application software with software downloaded via an in-band DTC, out-of-band FDC. Alternatively for Games Consoles and PCs software may be provided via a CD/DVD or via a dial-up interface.

According to yet a further aspect of the present invention various different protocol specifications may be used to facilitate the transmission of data within a Forward Data Channel (FDC), Reverse Data Channel (RDC) or Digital Transmission Channel (DTC) for providing games on Cable TV. These may include DVB-C, MCNS, DVB-RCCL, IEEE 802.14 or DOCSIS.

Digital Video Broadcasting Cable (DVB-C) is a European standard adopted by many European and UK Cable TV operators to provide interactivity and data to subscribers set top boxes. Return Channel For Cable and LMDS (DVB-RCCL) is a variant of the European standard adopted by many European and UK Cable TV operators to provide interactive return path used by subscribers set top boxes to transmit data and requests upstream to a server.

Multimedia Cable Network System (MCNS) is a US protocol standard adopted by many Cable TV operators to provide interactivity and data to subscribers set top boxes. Data-Over-Cable Service Interface Specification (DOCSIS) is European standard adopted by many European and UK Cable TV operators to provide data over fiber to subscribers set top boxes.

According to yet a further aspect of the present invention subscribers who use a Direct broadcast satellite (DBS) may be provided with a DVB-S Satellite modem which is operable to interface a STB, Games Console or PC to a 18-inch direct satellite receiver dish.

The DVB-S modem may be built in to STB or connected via a USB port. The DVB-S receiver/modem may also be connected to a Games Console via a type III PCMCIA Port or via a USB or Firewire port. The games console type III PCMCIA Interface provides an interface between the satellite modem and the mini dish.

A DVB-S receiver/modem may be connected to a PC via a PCI Port or via a USB or Firewire port. The PCs PCI Port provides an interface between the DVB-S satellite modem and the satellite receiver dish. The Satellite modem may also be interfaced via a dial-up interface to the Satellite TV provides ADSL network.

The satellite-modem DVB-S interface is operable to receive digital signals from a GEO satellite and isolate channels containing game data. It converts the digital signal to an analogue format, and checks for errors. In this way game data may be directly broadcast to subscribers Games Consoles, STB or PC via a wide swath by geostationary orbit (GEO) satellites. For example data provided by the Games Server may be transmitted via ground based uplinks as a digitised signal to a GEO Satellite which is operable to beam the signals across a wide swath which may be received by a subscribers 18-inch satellite dish. This signal may then be feed via a coax cable to a satellite modem within a Games Console. The CPU is operable to buffer the data into a game console's dynamic random access memory (DRAM) and the Game is rendered using the random access memory (RAM).

It will be appreciated that various different satellite bands may be used when transmitting data over a satellite including C-Band, Ka-Band and Ku-Band which may provide data rates of up to 45 Mbps per signal. This high-speed data rate is facilitated through a mini dish and a satellite modem. Of course other transmission bands may be used to transmit data via a GEO Satellite to a subscribers Games Console, PC or STB including, S-Band, L-Band, V-Band, VHF-Band, UHF-Band and X-Band.

Those skilled in the art realise that though the return path/ reverse data channel speeds are limited to dial-up telephone-modem transmission rates. However through a Ka-band Satellite it is possible to support a return path without a dial up interface.

Satellite DVB-S (Digital Video Broadcasting Satellite) protocol specification may be used by the Games System to facilitate the transmission of data by a Satellite Modulator over FDC. Satellite Modems within users Games Console, PC or STB which may also use the DVB-Satellite Return Channel (DVB-RCS) protocol specification to transmit data over DSL to the Hub thereby providing the reverse data channel (RDC).

Similarly with digital terrestrial TV a protocol specification known as DVB-T (Digital Video Broadcasting Terrestrial) may be used by the Games System to facilitate the transmission of data via a transport network to a users Games Console, PC or STB. The DVB-Terrestrial Return Channel (DVB-RCT) protocol specification may also be utilised by a dial up modem to transmit data over DSL to Hub. In this way a RDC may be initiated from a users Games Console, PC or STB to the Hub.

Alternative transport protocols including IEEE 802.14, DVB-RC Return Channel System may also be used to provide the return path functionality. It will also be appreciated that various different protocols including TCP/IP, UDP, FTP, HTTP and IP may be used to transmit data over a QPSK, BPSK or a QAM signal to a Games Console, PC or STB.

According to the present invention the Game Servers consists of rack-mountable computer chassis features a passive backplane, slots for peripheral and hot swappable CPU modules, RAM, DRAM, SDRAM, VNRAM, multiple network interface input/outputs (I/O), V.90 modem, DVB-C/MCSN Cable modem and a high-capacity, high-bandwidth, integrated storage subsystem.

Based on a multiprocessor system the Games Servers are optimised for scalability and fault tolerance that is particularly required within the broadcast environment for an acceptable quality of service. It will be appreciated that CPUs may be provided by number of manufactures including IBM, Motorola or Intel.

According to yet a further aspect of the present invention the Games Server network interfaces may be based on a Gigabyte System Network (GSN) to Fiber Channel (FC) bridge suitable for both Cable, Satellite and Terrestrial TV networks. The Games Servers are coupled with disk arrays capable of storing and retrieving up to a trillion bytes per second with a data output capable of exceeding a billions of bytes per second of games data as will be described. This is advantageous.

According to yet a further aspect of the present invention the Game Servers are operable to connect through multiple network interface input/outputs (I/O) to a TV network backbone which can provide various speeds of gigabytes per second between a number of industry standard communication fabrics such as Gigabit Ethernet and Asynchronous Transfer Mode (ATM). This is advantageous.

According to yet a further aspect of the present invention the Game Servers may be configured to meet specific network connectivity requirements. Connectivity with HFC cable, DSL, high-bandwidth fiber trunk, and/or IP-based networks may be provided by a wide variety of network interface controllers including integrated QAM 64 and QAM 256 modulators with or without integrated frequency upconverters, DVB-ASI, ATM/OC3c, 10/100BaseT, and Gigabit Ethernet.

The Games System is designed to support multiple network connectivity options including hybrid fiber coax (HFC) cable, digital subscriber line (DSL), high-bandwidth fiber trunks, and IP-based networks as previously described in GB 0203790.1, thereby supporting present TV operators installed network transports without the requirement for costly investment transport overhauls. In this way the Game Servers are operable to be configured to meet specific performance requirements of cable, satellite or terrestrial TV operator Head-Ends and networks. This is advantageous.

According to yet a further aspect of the present invention the storage subsystem is based on multiple hard discs, Disk Arrays, Optical Disc Drives, DVD Drives and hot swappable removable disk drives that provide terabyte capacity.

Alternatively data streams that are provided by Games Server to subscriber may be constructed from data that may be stored on QAM content servers, digital networks, satellite down/up links, Fast Ethernet, video decoders, and VHF/UHF signals.

Similarly video and audio streams that are provided by Games Server 12 to subscribers may be constructed from data that may be stored on disk drives, digital networks, satellite down/up links, Fast Ethernet, video decoders, and VHF/UHF signals.

Preferably the Games Server software is run on a Windows NT, Sun Solaris or Unix operating system. Each Games Server node is Windows NT, Sun Solaris or Unix platform-certified. The Windows NT operating system includes support for such standard devices as the Video Graphics Adapter (VGA), modem, Ethernet, and disk controllers.

It will be appreciated that the Games Server software may be run on any number of operating systems including those developed specifically the Sony PS2, Nintendo Gamecube, X-box or Sega Dreamcast systems that may be implemented within Games Server software architecture. Those skilled in the art will realise that each operating system has a varied C++ development compatibility. Of course the Games Server Software could be specifically developed for either of the above mentioned operating systems, thereby enabling the integration of PS2, Nintendo Gamecube, Dreamcast or X-box graphics hardware in the Games Servers hardware architecture. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a user may trigger a game to download directly relating to video on DTC or ATC to their Games Console, PC or STB. For example a user may be watching a video preview of a game on channel 288 on their cable TV during which they are prompted to download a game on to their Games Console by a red icon in screen. If the user responds by pressing the red button then a signal is transmitted to STB that in turn transmits signal for authentication. Authenticated, switch channels to correct program source for the game and the game is transmitted to the games console via a DTC. Alternatively the user may have responded to the video preview of a game by pressing a button on their games pad. This is advantageous.

According to yet a further aspect of the present invention users may access and download games through a user interface provided over a TV channel. This is achieved through transmitting HTML/Java data in the DTC, in-band Forward Path, or an out-of-band forward data channel (FDC) to a subscribers STB, Games Console or PC. Using a Middleware engine the subscribers STB, Games Console or PC is operable to render the user interface (UI) using the HTML and Java objects provided by a Middleware or Proxy Server. Those skilled in the art will realise that the UI is typically realised within the RAM of a STB, PC or Games Console.

Preferably video previews of games available may be provided within the user interface. This is achieved through overlaying HTML, Jpeg and GIF graphics on video received within an out-of-band or in-band signal. In this way the viewer may visually select a game by highlighting a game of their choice using a remote control or games pad.

The subscriber is then able through using the remote control or games pad to navigate user interface by manipulating the buttons provided. In this way the user is able to select a game using their remote or games pad, which triggers a receiver in STB, Games Console or PC to switch channels to correct Program Identity (PID) relating to

game selected. Once the correct PID is selected a resident application is operable retrieve the data from a FDC or DTC on to the memory of a STB, Games Console or PC from which the game may be rendered. Those skilled in the art will realise that a game is typically rendered with the RAM of a STB, Games Console or PC. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby games are provided continuously via a digital transmission channel (DTC) or forward data channel (FDC). This is achieved through configuring the Game Server to continuously retrieve and output data over multiple MPEG-2 streams aggregated into a DTC or FDC through interfacing with the QAM Modulator and QPSK Modulator. In this way users may download or retrieve data from a DTC or FDC on to a Games Console, PC or STB at anytime.

In this way game data required by a subscriber may be stored on the Games server and transmitted continuously to all subscribers tuned into a specific channel or on demand to specific user via a FDC. Through interfacing the Game Servers with a QAM Modulator, at the Headend, games maybe transmitted continuously over a DTC from which games maybe downloaded onto a games console, PC or STB.

The advantage of transmitting the game data continuously is that only one copy is needed on a single server. This however does not limit the number users who access the game data, as the games are download via a digital transmission channel (DTC). Thereby enabling hundreds of thousands if not millions of users equipped with a Games Console, PC or STB equipped with suitable receiver to access a game at anytime and without the need for broadband or ADSL connection. This is advantageous.

Whereas with existing internet systems which require the user to have a broadband connection the game is not provided continuously as there is no DTC but on demand thereby requiring multiple copies of a single game to be stored on multiple servers which limits accessibility and scalability. This is disadvantageous.

Through providing game data over a DTC or ATC the games are being broadcast over airwaves, which may be incepted by anyone with a receiver that is tuned into the right signal channel. Those skilled in the art will realise that a channel is a separate incoming QAM signal or ATC source that a user can select through an RF tuner. As such a channel has a defined bandwidth of 6 to 8MHz that may be utilised to provide data to all users Games Console, PC or STB that a tuned into channel. Typically a channel will exist within a range of 50-850MHz on a cable, satellite or terrestrial television network.

It will be appreciated that all DTC or ATC have bandwidth and that the amount of bandwidth required is only proportional to the size of a game and not the number of users. In a traditional Internet system bandwidth is directly proportional to amount of data transmitted and the numbers of users. This is disadvantageous.

Alternatively the Games Server may be configured to broadcast game data to multiple users over the Internet using a technique referred to as multicasting, however the recipient would then require a broadband or ADSL connection.

According to yet a further aspect of the present invention the Game Server maybe interfaced with the QPSK Modulator at the Headend or Hub, whereby games maybe transmitted continuously or on demand over a Forward Data Channel (FDC) from which games maybe downloaded onto a Games Console, PC or STB. This is advantageous.

This process of selecting and downloading a game from a FDC may be initiated by a request for game that may formed by the Game Server or a number of alternative user devices, including STB, Games Console or PC. Requests formed by a STB, Games Console or PC may be provided to Games Server via the Reverse Data Channel (RDC). A Cable Modem, Satellite Modem or Terrestrial Modem using QPSK modulation provides the RDC. In this way requests may be transmitted upstream to the Game Server.

For example a request may be initiated through a resident application on a STB, PC or Games Console for a specific game that has been provided by a resident application relating to a video preview of a game on a DTC. A Specific Channel ID, Service ID, is used to define the game requested and Packet ID within an MPEG-2 Transport stream or a URL provided by the Game Server.

Alternatively the request may be initiated by the Game Server whereby game data is retrieved from a disk array and provided within an out-of-band FDC continuously thereby not requiring a request to constructed by a resident application on a STB, Games Console or PC to initiate the download.

When a STB, Games Console or PC requests a game data is subsequently retrieved from either an in-band DTC or out-of-band FDC signal and loaded into the memory on the device in order for the game to be realised. For example a STB might cache the Game data into the flash memory or DRAM from which the Game is then rendered and displayed on the TV screen. Whereas a Games Console might cache the Game data into the Random Access Memory (RAM) from which the Game is then rendered and displayed on the TV screen.

According yet a further aspect of the present invention the method of providing games consists of retrieving game data from the Games Servers Storage Subsystem which is then output through a network interface to an MPEG encoder. The MPEG encoder is operable to encode the data into MPEG 2 transport streams which may be combined with video and audio streams which are then multiplexed into a single in-band Digital Transmission Channel DTC or an out-of-band Forward Data Channel and provided as a constant data bit stream.

A DTC is an out-of-band 256 QAM Waveform that is modulated by a QAM Modulator typically at bandwidth of 6MHz providing a total throughput of 36.5Mbps. The term in-

band signals refer to use of transmission channels that are typically used to provide HDTV or digitally encoded signals.

A FDC is an out-of-band QPSK Waveform that is modulated by a QPSK Modulator typically at bandwidth of 1MHz providing a total throughput of 6Mbps. The term out-of-band signals refer to use of non-transmission channels that are not used to provide HDTV or digitally encoded signals due to lower capacity.

Data provided by the Games Server within the DTC may be stored on multiple hard discs, Disk Arrays, Optical Disc Drives, DVD Drives and hot swappable removable disk. Alternatively data provided by Games Server 12 within DTC may be retrieved from data that may be stored on QAM content servers, digital networks, satellite down/up links, Fast Ethernet, video decoders, and VHF/UHF signals.

Video and audio streams that are provided by Games Server 12 to subscribers may be constructed from data that may be stored on disk drives, digital networks, satellite down/up links, Fast Ethernet, video decoders, and VHF/UHF signals.

A native application coded in C or C++ is operable to retrieve data from the Game Server sub storage system which is output directly to an MPEG encoder that is operable to encode the data into MPEG-2 Streams. These MPEG Streams may then be transmitted within an in-band DTC or out-of-band signal to subscribers STB's, Games Consoles or PCs. As previously described an application resident on the subscribers STBs, PCs or Games Consoles is operable to interpret the data and render a game that is realised within the RAM.

The Game Server may also be directly interfaced with the QAM modulator and QPSK modulator through GSN or Fiber based I/O Network interfaces as previously described. The Games System is designed to support variable channelisation and supports 4, 16, 32, 64, 128 and 256-QAM. These modulations provide various different bit rates, which may be used to support various Cable, Terrestrial or Satellite TV operator's bandwidth and spectrum availability.

For example the Games Server may be configured to provide an output bit rate of 25 Mbps suitable for transmitting data on a single 6MHz (DOCIS) in-band 64-QAM Waveform. Alternatively the Games Server may be configured to output 55.6 Mbps suitable for transmitting data on a single 8Mhz (Euro-DOCIS) in-band 256-QAM Waveform. This is advantageous. The Games Server may also be configured to provide an output bit rate of 45Mbps suitable for transmitting data on 11Ghz (DBS) Ka-band or Ku-Band Signal as will be described.

Data, audio and video output from the Games Server is digitally encoded by an MPEG encoder and provided as a constant bit rate data, audio and video streams which are multiplexed and modulated into in-band QAM signal or out-of-band QPSK signal and transmitted to subscribers STBs, Games Consoles or PCs. This eliminates the overhead of context switches and data copies that standard user-mode interfaces

require. In addition this lowers CPU utilisation and I/O latency, providing an environment suited to high-performance, constant bit rate applications. Software Application developed for the Games Server operating system handles the transfer of video, audio and data objects.

Alternatively the Games Server may contain several MPEG video pumps that are operable to provide an aggregate MPEG-2 transport stream throughput of over 800 MB/s per second per encoder. This eliminates the need to interface the Games Server with MPEG encoder.

According to yet a further aspect of present invention means may be provided whereby up to 20 MPEG-2 data transport streams may be aggregated into one 256-QAM Digital Transmission channel, which may be provided continuously over a Broadcast File System (BFS). This is achieved through combining multiple MPEG-2 data transport streams in to a signal 256-QAM Waveform that may be broadcast to all viewers over a Cable TV network, Satellite link or Terrestrial UHF transmission.

It will be appreciated that this may be scaled to suit the TV operator's requirements whereby up to 200 or more MPEG-2 transport streams each containing a different game may be provided continuously as date stream over multiple transmission paths including in-band QAM or out-of-band QPSK signals. It will be appreciated that the transmission path used to transmit game data to subscribers STB, Games Console or PC could include a multiple of communication paths including Ka-band, Ku-Band, C-band, L-band, N-band satellite links or UHF/VHF terrestrial signals. This is advantageous.

According to yet a further aspect of the present invention game data that is stored on the Game Server Storage Subsystem may be transmitted over a variety of links to a users Games Console, PC or STB including Radio Frequency Links (UHF/VHF), Digital Broadcast Satellite Links, Cable TV Networks Transmissions, Standard Terrestrial Communication Links (PDH, SDH), Microwave Line of Sight (LoS) Links (wireless), Digital Subscriber Links (ADSL family) and Packet / Cell Links (ATM, IP, IPv6, Ethernet).

Those skilled in the art will realise that a data transmission may be provided over a simplex or full duplex (using an interaction channel for the return) and may be Unicast (point-to-point), Multicast (one to many) or broadcast (all receivers receiving the assigned PID).

According to yet a further aspect of the present invention there are five main methods of providing game data within a DTC or FDC to a users Games Console, PC or STB which consist of Data Piping, Data Streaming, Data Carousels or Object Carousels.

Data Piping is a method used by the Games Server to deliver discrete pieces of data using containers to the destination. Those skilled in the art will realise that typically

there is no timing relationship between other (PES) packets and the game data packets.

Data Streaming is a method used by the Game Server to retrieve data, which takes the form of a continuous stream that is carried in an asynchronous PES.

Data Carousels is a method that may be used by the Game Server for assembling game data sets into a buffer, which are played-out cyclic manner (periodic transmission). The data sets may be of any format or type i.e. HTML, Java or C++. For example this technique may be used to provide the data for an onscreen On-line Games Guide. Those skilled in the art will realise that the data may of course be transmitted using fixed sized DSM-CC sections.

A yet further method that may be used by the Game Server is referred to as an Object Carousel. Object carousels typically resemble data carousels, however they are primarily intended for the broadcast of data services. Those skilled in the art will realise that the data sets are typically defined by the DVB Network Independent Protocol specification and may be used, to down-load data to a Games Console, PC or STB.

The majority of Cable, Satellite and Terrestrial TV operator networks currently uses a Broadcast File System (BFS) for transporting data repeatedly over the network. This enables the TV operator to provide data such as EPG listings continuously to an STB. Through the present invention the BFS allows a Games Console, PC or STB to quickly access games at anytime without requiring the use of an RDC to request data from the Game Server. This mechanism is useful where large numbers of subscribers require the same game data. An example would be where the same game is made available to any Games Console that has access to the DTC or FDC. This is advantageous.

It will be appreciated that a number of different transport protocols may be used to transmit data over a network to an STB, Games console or PC such as Schedule Transfer (ST), TCP/IP, RTSP and IPTV. Through utilising transport protocols such as ST this provides an optimal data output suitable to transmit game data over TV operators network or a DTC.

Through continuously outputting data from the Game Server over the BFS a subscriber may access and begin to download a game at any point of the data cast regardless of when the user triggers the download. Any data provided within the BFS that is transmitted via in-band QAM or out-of-band QPSK signals may be accessed through a data stream manager resident on the users STB, Games Consoles or PCs which is activated on users request.

The data stream manager is a resident application on the user STB, Games Consoles or PCs enables game data to be retrieved and interpreted from the BFS into the device DRAM or Flash memory where it is then rendered on a TV Screen. Those skilled in the art will realise that a game is typically realised in the RAM of a device.

In this way the TV operator is only required to provide one 2Mbps MPEG-2 streams per game as opposed to per user to their total subscriber base. For example using the present invention described in the UK TV operators could provide a 2Mbps MPEG 2 stream over a satellite link to 5.5 million subscribers from which a game could be retrieved on to a STB, Games Console or PC at anytime. This is achieved through transmitting data that is retrieved from the Games Server sub storage system and provided continuously over a transmission channel. This eliminates the need for a dial up connection and provides a low cost yet high-bandwidth delivery of games to subscribers. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a user is not required to download an entire game to play. Through BFS a Games Console or PC are operable to access data just as they would from a CD or DVD whereby only the data required for the game level is loaded into the memory. In this way the subscribers does not have to download the entire game onto a hard disc or Personal Video Recorder (PVR) to be played.

Similar to a DVD or CD games system a Games Console or PC will only load what is required from BFS, which is provided continuously within a DTC or FDC. Those skilled in the art will realise that a game is typically realised within the RAM or a Games Console or PC.

In this way the BFS acts as storage for all games each with a unique Packet ID identifiable within a unique MPEG-2 Stream that is provided continuously over a FDC or DTC. This is advantageous. This may also applied to STB as it has limited storage capacity

Through utilising the BFS data may be retrieved and rendered by a Games Console, PC or STB without requiring a hard disc, optical disc drive or removable storage. This is achieved through buffering data into DRAM of Games Console, PC or STB. From which the CPU is operable is render the game through utilising the RAM. As the subscriber progresses through the game, data is retrieved from the DTC or FDC, which is similar to a DVD or CD usage in a Games Console. Each game is designed to retrieve data from the DTC or FDC similar to the use of DVD on CD whereby only data relating to a particular level is loaded into the device memory.

This removes the necessity for storage capacity on the users device as all the game data may be stored and retrieved from within BFS, which is provided continuously over a DTC or FDC to a users device.

Preferably though the subscriber is equipped with hard disc which can be utilised by the CPU to store game data retrieved from the BFS. Thereby enabling games to be stored locally on the subscribers Games Console, PC or STB.

As will be appreciated various formats may be used to transport the game data including MPEG-4, DigiCipher II and Raw Transport Data (RTD). Preferably though an

MPEG-2 format is used to transport the game data to a user's device. This has the advantage of being supported by mostly all digital TV operators.

According to yet a further aspect of the present invention a subscriber's STB, Games Console or PC is operable to retrieve raw data sent in MPEG-2 private sections. This is achieved through transmitting data and video over the same transport stream or when a Games Server does not utilise the BFS. Resident applications within the users STB, Games Console or PC enables data provided with MPEG-2 private data stream to be interpreted and a game to be rendered on the users TV screen. In this way the user is able to retrieve data within the MPEG-2 transport stream that can be interpreted by a Games Console, STB or PC and a game may be loaded on screen.

The STB, Games Console or PC is operable to access data within the MPEG-2 data stream through utilising the stream manager a resident application which ensures that the device tuned into the correct frequency and PID of the game requested by the user.

According to yet a further aspect of the present invention means may be provided whereby software drivers may be provided to Games Consoles, PC or STB via a digital transmission channel (DTC). In this way when a user accesses a digital transmission channel the necessary software drivers to play a game may be provided directly to viewers Games Console, PC or STB which may be provided over a DTC or FDC and stored as resident applications. For example the drivers may include a graphics engine required to render games available on the games system. This is advantageous.

Alternatively means may be provided whereby a user can select and download drivers from GUI. These drivers may be specific to a device that may be connected to viewers Games Console, PC or STB to play a game such as an Infrared or USB Games Pad.

According to yet a further aspect of the present invention means may be provided through a GUI whereby a user can select and download multiple games at same time on to a Games Console, PC or STB. The data may be stored on a hard disc, personnel video recorder (PVR) or a secondary memory device connected via a USB or Firewire port to a Games Console, PC or STB. In this way a subscriber may store games locally on their device. This is advantageous.

This is achieved through aggregating several MPEG-2 transport streams each containing data relating to a specific game within one in-band 8 MHz 256-QAM signal. Within one 8 MHz 256-QAM signal there is a maximum of 56 Mbps total data throughput in which each game may be provided within 8 Mbps MPEG-2 streams simultaneously. The user may therefore download up to four games at a rate of 8 Mbps from a single DTC. At a low rate of 3 Mbps allocated to each game up to 18 games may be downloaded at the same time over a single DTC. However at a low rate of 3Mbps the games would take noticeably longer to download.

For example if each game is 600MB then with a 12 Mbps connection this would take 50 seconds to download one game multiplied by 4 this would take 3 minutes and 33

seconds approximately. Whereas with a 3 Mbps connection this would take 3 minute and 20 seconds per game which multiplied by 18 would take approximately 58 minutes.

Alternatively multiple games may be retrieved from an out-of-band QPSK signal which set at 6 MHz would provide a total throughput of 36 Mbps in which several games could be provided. For example means may be provided whereby a subscriber may prompt a GUI provided within a DTC which would enable them to select and highlight multiple games which may be provided over a QAM or QPSK signal to a Games Console, STB or PC. Preferably previews of the games may be broadcast or streamed within the GUI thereby enabling the subscriber to preview a game before downloading. This is advantageous.

According to yet a further aspect of the present invention the Command Server is operable to vary the rate of the transport streams in relation to size of game. The rate may be adjusted from 512 Kbps up to 56 Mbps per game. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a game that a Games Server has provided to a subscribers Set Top Box (STB) over a DTC or FDC may be saved. Means may be provided whereby a Game may saved within the flash memory of a STB as a resident application from which the subscriber may select and load a game from the point the game was saved. This is advantageous.

Alternatively a game may be saved on a USB memory card connected to the STB via the USB port. A resident application on the STB would enable a subscriber to save and load saved games stored on the USB memory card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a STB on a Smart card which may be inserted in a smart card drive. A resident application on the STB would enable a subscriber to save and load saved games stored on the Smart card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.

Alternatively means may be provided through a resident application on the STB would enable a subscriber to save and load saved games stored on hard disc or a Personal Video Recorder (PVR). In this way a subscriber may select and load a game from the point the game was saved. Through utilising a hard disc or a Personal Video Recorder (PVR) a subscriber would be able to save a significant number of games. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a STB on a Games Server which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a DTC which would enable a game to saved

be on the Games Server. A resident application on the STB would enable a subscriber to select and load a game from the point the game was saved on the Games Server. This is advantageous.

Alternatively a saved game executable file may be stored within a STB's flash memory or EEPROM as an instruction which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the flash memory or EEPROM that may be provided within a user interface of a Game. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a game that a Games Server has provided that to a subscribers Games Console over a DTC or FDC may be saved. Means may be provided whereby a Game may saved within the memory card of a Games Console as a resident application from which the subscriber may select and load a game from the point the game was saved. This is advantageous.

Alternatively a game may be saved on a USB memory card connected to the Games Console via the USB port. A resident application on the Games Console would enable a subscriber to save and load saved games stored on the USB memory card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.
According to yet a further aspect of the present invention means may be provided whereby through a resident application on the Games Console this would enable a subscriber to save and load saved games stored on hard disc or an Optical Disc Drive. In this way a subscriber may select and load a game from the point the game was saved. Through utilising a Hard disc or a Optical Disc Drive a subscriber would be able to save a significant number of games. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a Games Console on a Games Server which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a DTC which would enable a game to saved on the Games Server. A resident application on the Games Console would enable a subscriber to select and load a game from the point the game was saved on the Games Server. This is advantageous.

Alternatively a saved game executable file may be stored within the Games Console memory card or EEPROM as an instruction which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the memory card or EEPROM that may be provided within a user interface of a Game. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a game that a Games Server has provided that to a subscribers Personal Computer (PC) over a DTC or FDC may be saved. Through a resident application on the PC this would enable a subscriber to save and load saved games stored on hard disc or an Optical Disc Drive. In this way a subscriber may select and load a game from the point the game was saved. Through utilizing a hard disc or an Optical Disc Drive a subscriber would be able to save a significant number of games. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a PC on a Games Server which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a DTC or FDC which would enable a game to saved on the Games Server. A resident application on the PC would enable a subscriber to select and load a game from the point the game was saved on the Games Server. This is advantageous.

Alternatively a saved game executable file may be stored within the PC hard disc or EEPROM as an instruction which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the hard disc or EEPROM that may be provided within a user interface of a Game. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a
User can access a Graphical user interface from an in-band DTC or out-of-band FDC that enables the user to select multi-player networked games using a STB, Games Console or PC and play against other subscribers.

For example a Satellite TV subscriber might access a GUI from an in-band DTC by pressing the select button on a Games Pad. Data containing HTML and JavaScript objects is then retrieved from the DTC to the Games Consoles memory. Using the HTML and JavaScript objects the Games Console is operable to render the GUI. Those skilled in the art will realise that a GUI is typically realised within the RAM of a STB, PC or Games Console.

Within the GUI the subscriber is presented with a list of multi-player networked games including details of number of players, duration of play, game in session, difficulty level, author, publisher and channel. Preferably MPEG 1 video previews of live multi-player networked games in session may be provided within the user interface. This is achieved by using data inputs retrieved from a Games Console, STB or PC to render the games graphics on Game Server situated in Head-End as described in previously in GB 0129161.6 and GB 0203790.1.

Through using a Games Pad or Remote control a subscriber may highlight and select a multi-player networked game to join in. If the subscriber selects a game then a resident

application on the Games console switches the DVB-S receiver/modem to the correct DTC or FDC relating to the games PID. Data is then retrieved from the DTC or FDC on to Games Console DRAM. The game is then realised within the RAM.

A two-way communication path is then established between the Games Server and Games Console enabling data inputs to be exchange. Data inputs are centrally exchanged via the Games Server and each participating subscriber's Games console. Using the Data inputs from the participating subscriber's Games consoles provided by the Games Server via an in-band DTC satellite signal or out-of-band FDC over ADSL the Games console is operable to render the game.

Data inputs are then provided to the Games Server within a 1MHz QPSK Waveform initiated by the DVB-S receiver/modem via a dial-up interface. This provides an Reverse Data Channel (RDC), often referred to as the return path, in which data inputs may be transmitted upstream to a Games Server which may then be transmitted to participating subscribers via an in-band DTC satellite signal or out-of-band FDC over ADSL. In this way a subscriber may select and join in a multi-player network game from GUI provided over an in-band DTC or out-of-band FDC. This is advantageous.

It will be appreciated that this method of providing multi-player networked games may be provided to any Satellite, Cable or Terrestrial TV subscriber with a Games Console, STB or PC that include a receiver/modem capable of transmitting and receiving data provided over at out-of-band FDC or in-band DTC. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby sound and music may be provided by the Games Server within an in-band digital transmission channel (DTC) or out-of-band forward data channel (FDC) as MPEG audio stream to enhance the user interfaces of a game. In this way music or sounds may provided as a signal which may decoded by a receiver within STB and output from a Television set internal or external speakers.

For example a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB. The STB Central Processor Unit then interprets the signal and transmits an instruction to the modem/receiver that is operable to retrieve data, audio and video from the DTC relating to the Service and Packet ID of the game that was selected. The data is then retrieved from the DTC and buffered into the STB flash memory and rendered within the random access memory.

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen that is connected to the STB via a Scart lead. Software on the subscribers STB is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the DTC which may include an instruction to decode one or more MPEG audio streams whilst the UI is displayed on the TV screen.

An MPEG decoder in the STB is operable to decode the MPEG audio provided over the DTC that is then output from the subscriber's television speakers. Music and audio relating to the games UI may then be heard. This enhances the game menus by integrating sound and music without requiring the data to downloaded and stored on the STB flash memory. In addition as the audio or music is provided as MPEG audio stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the audio or music is provided as MPEG audio stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

Of course this may also be used for other applications or user interfaces not relating games including banking, e-mail, electronic program guides, betting and shopping. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby video provided by the Games Server within an in-band digital transmission channel (DTC) or out-of-band forward data channel (FDC) is combined with data stream at the Head-End and transmitted to a subscribers STB.

At the subscribers STB the CPU use HTML/JavaScript or C+ objects and the STB RAM to render a game's user interfaces or menus. The user interface is then rendered over video, which has been decoded by an MPEG decoder in the STB. In this way video, audio and images may be provided to enhance the UI of a game and enable motion backgrounds. As previously described audio provided with an MPEG-2 stream may also be decoded by a receiver within STB and output from a television set internal or external speakers.

For example a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB. The STB Central Processor Unit then interprets the signal and transmits an instruction to the modem/receiver that is operable to retrieve data, audio and video from the DTC relating to the Program ID of the game that was selected. Data, video and audio are then retrieved from the DTC. The data is then buffered into the STB flash memory and the game is rendered within the random access memory (RAM).

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen that is connected to the STB via a Scart lead. Software on the subscribers STB is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the DTC which may include an instruction to decode one or more MPEG video streams whilst the UI is displayed on the TV screen.

An MPEG decoder in the STB is operable to decode the MPEG video provided over the DTC that is then output from the subscriber's television screen. Video relating to the games UI may then be seen in behind the game's menu. This enhances the game menus by integrating video without requiring the data to downloaded and stored on the STB flash memory. In addition as the video is provided as MPEG transport stream and decoded by MPEG decoder this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data required to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the video is provided as MPEG transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

Of course this may also be used for other applications or user interfaces not relating games including banking, e-mail, electronic program guides, betting and shopping. This is advantageous

According to yet a further aspect of the present invention music and audio affects during a game may be provided over an in-band QAM Signal or out-of-band QPSK Signal. It will be appreciated that multiple audio formats may be used by the Game Server to provide sound and music including Dolby Digital Surround Sound, MPEG 1 Layer 3 (MP3) and Audio Compression Level 3 (AC-3).

Through utilising in-band DTC or out-of-band FDC to provide music and audio during a game this reduces processing requirement, which is of particular advantage to a STB that has very little processing capabilities. This is advantageous.

This may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. This is advantageous.

According to yet a further aspect of present invention means may be provided whereby video provided over a in-band digital transmission channel (DTC) is utilised within a game as part games graphics. For example the foreground may be provided over DTC as a data stream and rendered by a STB, Games Console or PC over the video provided within the QAM Signal. Combined with the foreground graphics this then enhances the game quality and reduces the required data to be processed by a STB, Games Console or PC.

According to yet a further aspect of the present invention video provided within in-band DTC and combined with the foreground graphics may be rendered graphics by the Games Server. For example using a graphics engine on the Games Server a games

background may be rendered and provided as MPEG video which is then output by the server and combined with data stream by a Multiplexer into a 6 MHz QAM signal which is transmitted to the subscribers STB. It will be appreciated that this may be transmitted via cable, satellite or terrestrial communication paths as previously described in GB 0129161.6 and GB 0203790.1. Within the subscribers STB a MPEG decoder is operable to decode the video stream which is then output on TV screen. Using data also provided within QAM signal and the STB's random access memory, the CPU is operable to render the game's foreground graphics over the video. In this way the STB is not required to render the games background thereby reducing the number of processing transaction required of the CPU and RAM. Through rendering graphics on Games Server the graphics provided during a game can be enhanced to that equal to or greater than current Games console system. This is advantageous.

Additionally through freeing up the CPU and RAM this enables more enhanced graphics to be rendered by the STB including polygons, texture maps and simple 3D objects. This is advantageous. It will be appreciated that the background graphics provided by the Games Server may be pre-rendered thereby not requiring the Games server to render the games background. This is advantageous. In this way the STB, Games Console or PC are not required to process the background data as this is provided as a transmission within a QAM Signal. This is advantageous

Alternatively the background graphics may be provided over an Analogue Transmission Signal (ATC) with Raw Data or transmitted within the out-of-band FDC with compressed digitised data.

According to yet a further aspect of present invention means may be provided whereby video provided over a forward data channel (FDC) is utilised within a game as part games graphics. For example the foreground may be provided over DTC or FDC and rendered by STB, Games Console, PC however video within the FDC QPSK Signal may be utilised as the game background. Combined with the foreground graphics this then enhances the game quality and reduces the required data to be processed by a STB, Games Console or PC.

According to yet a further aspect of the present invention video provided within out-of-band Forward Data Channel may be combined with foreground graphics rendered by the views Games Console, PC or STB. For example using a graphics engine on the Games Server a games background may be rendered and provided as MPEG video which is then output by the server and combined with data stream by a Multiplexer into a 6 MHz QPSK signal which is transmitted to the subscribers STB. It will be appreciated that this may be transmitted via cable, satellite or terrestrial communication paths as previously described GB 0129161.6 and GB 0203790.1.

Within the subscribers STB a MPEG decoder is operable to decode the video stream which is then output on TV screen. Using data also provided within QPSK or QAM signal and the STB's random access memory, the CPU is operable to render the game's foreground graphics over the video. In this way the STB is not required to

render the games background thereby reducing the number of processing transaction required of the CPU and RAM. Through rendering graphics on Games Server the graphics provided during a game can be enhanced to that equal to or greater than current Games console system. This is advantageous.

Additionally through freeing up the CPU and RAM this enables more enhanced graphics to be rendered by the STB including polygons, texture maps and simple 3D objects. This is advantageous. It will be appreciated that the background graphics provided by the Games Server may be pre-rendered thereby not requiring the Games server to render the games background. This is advantageous. In this way the STB, Games Console or PC are not required to process the background data as this is provided as a transmission within a QPSK Signal. This is advantageous

According to yet a further aspect of the present invention means may be provided whereby video provided over an in-band digital transmission channel (DTC) is utilised within a game to provide full motion cut scenes.

For example a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB. The STB Central Processor Unit then interprets the signal and transmits an instruction to the modem/receiver that is operable to retrieve data, audio and video from the DTC relating to the Service and Packet ID of the game that was selected. Data, video and audio are then retrieved from the DTC. The data is then buffered into the STB flash memory and the game is rendered within the random access memory (RAM).

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen that is connected to the STB via a Scart lead. Software on the subscribers STB is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the DTC which may include an instruction to decode one or more MPEG video streams when the subscriber selects play.

An MPEG decoder in the STB is operable to decode the MPEG video provided over the DTC that is then output from the subscriber's television screen. Video relating to the games may then be played on the subscriber's TV screen and the subscriber views a video cut scene for the game. This enhances the game by integrating video without requiring the video to downloaded and stored on the STB flash memory. In addition as the video is provided as MPEG transport stream and decoded by MPEG decoder this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data required to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth usage which can be utilised to provide other services. In addition as the video is provided as MPEG

transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

According to yet a further aspect of the present invention video output by the Game Server that is provided within a QAM Signal of a Digital Transmission Channel, may be provided as continuous loop of video whereby random cut scenes are provided when a game is loading between levels.

Alternatively through aggregating several or more 3Mb/s MPEG-2 streams in to a single DTC it is possible to provide non-random cut scenes that are linked to users progress during a game. Using the Packet ID the MPEG-2 streams relating to a particular cut scenes may be requested during a game and identified within the DTC. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby video provided over an out-of-band forward data channel (FDC) is utilised within a game to provide full motion cut scenes. For example a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB. The STB Central Processor Unit then interprets the signal and transmits an instruction to the modem/receiver that is operable to retrieve data, audio and video from the FDC relating to the particular Service and Packet ID of the game that was selected. Data, video and audio are then retrieved from the FDC. The data is then buffered into the STB flash memory and the game is rendered within the random access memory (RAM).

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen that is connected to the STB via a Scart lead. Software on the subscribers STB is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the DTC which may include an instruction to decode one or more MPEG video streams when the subscriber selects play.

An MPEG decoder in the STB is operable to decode the MPEG video provided over the DTC that is then output from the subscriber's television screen. Video relating to the games may then be played on the subscriber's TV screen and the subscriber views a video cut scene for the game. This enhances the game by integrating video without requiring the video to downloaded and stored on the STB flash memory. In addition as the video is provided as MPEG transport stream and decoded by MPEG decoder this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data required to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the video is provided as MPEG transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

According to yet a further aspect of the present invention video output by the Game Server may be provided within a QAM Signal of a Digital Transmission Channel, which may be provided as continuous loop of video whereby random cut scenes are provided when a game is loading between levels.

Alternatively through aggregating several or more 3Mb/s MPEG-2 streams in to a single 6MHz QPSK FDC it is possible to provide non-random cut scenes that are linked to users progress during a game as will be described. This is advantageous.

According to yet a further aspect of the present invention multiple audio streams provided by the Games Server may be aggregated into a single DTC or FDC from which the subscriber's receiver is operable to switch between audio streams during game. Instructions carried within game provide unique Packet identifiers that may be interpreted by the subscriber's STB, Games Console or PC that is operable to switch to the correct MPEG transport stream using the Packet Identifiers (PIDs).

An instruction within the game data may instruct the subscribers STB, PC or Games Consoles decoder to switch to a MPEG audio stream with a particular Packet Identifiers (PIDs). This may be in menu when a subscriber highlights a selection in the game menu or may be during a game relating to a subscriber's inputs.

For example when subscriber selects to load a game on the games user interface (UI) an instruction may be transmitted by the STB CPU to switch MPEG streams to specified Packet Identifier (PID). The STB is operable to switch to the specified audio stream, which is then decoded by a MPEG decoder and output by the Television set internal or external speakers. The subscriber then hears an audio sample relating to their input on the UI. This is advantageous.

According to yet a further aspect of the present invention the Games Server is operable to provide up to 40 audio streams provided on a single 6MHz in-band DTC or out-of-band FDC that may be accessible during a game. This is achieved through aggregating 40 audio streams at a data rate of 384 Kbps, which is then combined with the several data streams containing different games and multiplexed into a single in-band QAM or out-of-band QPSK signal that has total throughput of 35 Mbps. Each audio stream may be utilised by a game played on a STB to enhance the gaming experience and quality. Software provided on the STB is operable to interpret data instructions that are provided during a game over a DTC or FDC to switch MPEG streams to correct PID.

For example during one level of a game up to eight audio streams may be used during the game and on completion four audio streams may be used. On more complex games up to 20 audio streams may be used during a game. It will be appreciated that some audio streams may consist of several or more sounds aggregated into a single MPEG 2 audio transport stream. As such some audio streams may share consistency with other streams such as background music or sound that relate to the game level as well as sounds relating to the subscribers inputs. This is advantageous.

According to yet a further aspect of the present invention multiple video streams provided by the Games Server may be aggregated into a single DTC or FDC from which the subscriber's receiver is operable to switch between video streams during game. Instructions carried within game provide unique Packet Identifiers (PID) that may be interpreted by the subscriber's STB that is operable to switch to the correct MPEG stream using the PID.

An instruction within the game data may instruct the STB decoder to switch to a MPEG video stream with a particular PID. This may be in menu when a subscriber highlights a selection in the game menu such as the saved games or may be during a game relating to a subscriber's inputs.

For example when subscriber selects to load a game on the games user interface (UI) an instruction may be transmitted by the STB CPU to switch MPEG streams to specified PID. The STB is operable to switch to the specified video stream, which is then decoded by a MPEG decoder and output via the Scart lead on the Television screen. The subscriber then sees a video sample relating to their selection of saved games on the UI. This is advantageous.

According to yet a further aspect of the present invention the Games Server is operable to provide up to 10 video streams provided on a single 6MHz in-band DTC or out-of-band FDC that may be accessible during a game. This is achieved through aggregating 10 video streams at a data rate of 2 Mbps, which is then combined with the several data streams containing different games and multiplexed into a single in-band QAM or out-of-band QPSK signal that has total throughput of 35 Mbps. Each video stream may be utilised by a game played on a STB to enhance the gaming experience and quality. Software provided on the STB is operable to interpret data instructions that are provided during a game over a DTC or FDC to switch MPEG streams to correct PID.

For example during a game an instruction to switch to specific PID may be initiated by the subscribers inputs on the remote control and progress in the game. An MPEG decoder in the STB is operable to decode the incoming MPEG stream, which is then displayed on the TV screen. This may of course be a pre-rendered scene provided by the Games Server relating to the subscriber's inputs or progress. This enhances the game by integrating video without requiring the video to be downloaded and stored on the STB flash memory. In addition as the video is provided as MPEG transport stream and decoded by MPEG decoder this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the amount of data required to be downloaded to a users Games Console or PC which in turn reduces the bandwidth used which can be utilised to provide other services. In addition as the video is provided as MPEG transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby remote co processing and assistance graphic processing is provided by the Games Server to enhance 3D and 2D graphics within a game. This is achieved by using data inputs provided by a subscriber's Games Console, PC or STB for the Games Server to render a game.

For example a user may prompt a game from a user interface using the Games Pad. The Cable Modem/receiver then performs a handshake with a Cable Modem Termination Unit (CMTS) situated typically situated in the Head-end. This may be DVB-C or MCNS based. A two-way communication is then established with the subscribers Games Console Cable Modem/receiver and Games Servers Cable Modem. The two-way communication consists of a Forward Path or Forward Data Channel (FDC) and an Reverse Data Channel (RDC).

The Game is then executed on the Games Server and a resident application is launched that enables the user's data inputs to be interpreted by the Games Server Central Processor Unit (CPU). A graphics processor card within the Games Console is operable to output RGB and composite signals from the Games Server.

An application resident on the Games Console is operable instruct CPU to transmit users data inputs within RDC which may received by the Games Servers situated that are operable to interpret the users data inputs and render 3D/2D graphics.

Rendered graphics are then output from Games Server graphics card as RGB, PAL, NTSC or composite signal to an MPEG real time encoder (RTE) and encoded and compressed within an MPEG 2 video transport stream in real time. The digital signal is the multiplexed within an in-band Forward Path or out-of-band Forward Data Channel (FDC) by a Multiplexer, using Time Divisional Multiplexing (TDM) and Frequency Division Multiplexing (FDM). The signal is modulated into a QPSK waveform or QAM waveform depending on whether the signal is transmitted within a in-band forward path as private MPEG stream or within an out-of-band FDC.

The signal is then transmitted over the Cable TV operators transport network that consists of a series of Universal Broadband Routers (URB) connected over optical cables layer 12 or 48 to the hub where signal is then transmitted over Access Network to subscribers Games Console.

Signal is then demultiplexed, demodulated by the Cable Modem/receiver within the Games Console before being buffered into the MPEG decoder's memory for playback. The signal is the decoded by the MPEG decoder and output via a AV lead to TV screen.

Through manipulating the buttons on the games pad the user is able to control the game. The data inputs are continuously transmitted within a RDC via the Cable Modem to Games Server that renders the game. The rendered graphics are the received within an in-band DTC or out-of-band FDC and displayed on the user TV screen.

In this way the entire game may be rendered by the Games Server or partially rendered which enables far more complex and detailed 3D scenes to be rendered during a game than supported by a STB, Games Console or PC to be rendered within a game. This is advantageous.

It will be appreciated that the any modem for example a 28 Kbps or 56 Kbps modem may be used to transmit data inputs upstream via return path to Games Server and that any 28 kbps to a 56 kbps modem may be used by the Games Server to receive data inputs.

According to yet a further aspect of the present invention DTC may be utilised to provide in game video cut scenes, whilst a STB, Games Console or PC retrieves data from the DTC or a FDC. Thereby enabling a game to be loaded whilst viewing a cut scene. This is advantageous.

Alternatively in game cut scene videos may be provided by a Game Server within the out-of-band Forward Data Channel. This is achieved through utilising an MPEG-2 transport stream within a QPSK Waveform to provide video that is transmitted over the networks transport infrastructure to a users STB, Games Console or PC. An MPEG decoded with the subscribers STB, Games Console or PC is operable to decode the video that is then displayed on the subscriber's TV or SVGA screen if using a PC.

According to yet a further aspect of the present invention in game cut scenes may be provided on demand whereby a request is formed by users device and transmitted via the RDC to Game Server which is operable to interpret request and stream the required cut scene as Private MPEG-2 video within the FDC to a users device. An MPEG decoded with the users Games Console, PC or STB is operable to decode the video that is then displayed on the TV screen. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby viewers are able to view live Multi-player networked games on a TV channel in which the voices of participating viewers can be heard. A microphone or voice headset connected to a Games Console, STB or PC enables audio to be captured from the subscriber. Voice and data inputs are transmitted upstream within out-of-band reverse data channel (RDC) from each participating viewer's Games Console, STB or PC to the Games server situated within the Head-End.

As previously described the RDC is a QPSK waveform generated by the modem using forward modulation techniques. The QPSK RDC may provide a data rate of up to 6 Mbps on Cable TV, whereas with Satellite and Terrestrial TV the capacity is typically slightly less at about 2 Mbps over ADSL.

The data inputs provided within a QPSK signal in the RDC the Game Server is operable to render a live game graphics using viewer inputs as previously described in GB 0203790.1. Video output by the Games Server in then combined with the audio

stream and transmitted over a in-band QAM signal. In this way, viewers who are tuned to the TV channel can view live Multi-player games and hear live voices of other viewers playing the game. Audio may be provided in stereo, joint stereo, dual channel (Stereo) or single channel (Mono).

Those skilled in the art will realise that bandwidth requirement of voice data is approximately
32 Kbps up to 448 Kbps, which equals 32 kHz to 48 kHz respectively, using MPEG 1 which is significantly less then that of the bandwidth available within the RDC which is equivalent to 1 to 6 MHz.

Through using MPEG 2 audio may be provided within a bit rates of 8 Kbps up to 256 Kbps which is significantly less then that of the bandwidth available within the RDC which is equivalent to 1 to 6 MHz.

It will be appreciated that any viewer, who has an RF tuner that is tuned into the specific channel frequency, will be able to view the live Multi-player networked game and hear the voices of other viewers participating in the game. This is advantageous.

Preferably viewers may select to join a live Multi-player networked game via a STB, Games Console or PC as previously described in GB 0203790.1

A specific embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which;

Figure 1 is a block diagram of the software architecture used to by a Games Console, STB or PC to access and interpret user interfaces and games.

Figure 2 is a block diagram of the software architecture used to by a Games Server to provide game data and video to Games Consoles, STB or PC via a QPSK or QAM Signal.

Figure 3 is a detailed block diagram of a Cable TV architecture that may be used by a Games Server to provide game data and video to Games Consoles, STB or PC via a QPSK or QAM Signal.

Figure 4 is a detailed block diagram of a Satellite TV architecture that may be used by a Games Server to provide game data and video to Games Consoles, STB or PC via a FDC QPSK signal or a QAM Satellite downlink.

Figure 5 is a detailed block diagram of a Terrestrial TV architecture that may be used by a Games Server to provide game data and video to

Games Consoles, STB or PC via a FDC QPSK signal or terrestrial UHF/VHF Signal.

Referring to Figure 1 the drawing, the users Games Console, PC or STB consists of six main layers of software, which includes an Application Program Interface (API) 1, resident applications 3, native applications 4, Operating System (O/S) 5, and embedded device drivers 6 within the sub O/S.

The Application Program Interface (API) 1 enables applications to be specifically coded for a subscriber's device including STBs, PCs and Games Consoles. The API 1 also provides at set routines used by applications resident on the subscribers STB, Games Console or PC to direct performance procedures by the Operating System (O/S).

The Resident applications 2 exist with flash memory of a STB or RAM of Games Console. Through an Application Specific Interface (AIS) on the Games Server a TV operator may update or configure resident applications within the STB by transmitting data within an out-of-band FDC or an in-band DTC. This is also possible with a Games Consoles or PCs via the in-band DTC and out-of-band FDC. The resident applications provide basic functions for the STB, Games Console or PC. For example in a Game Console this would include the Pay-Per-Play, Games Program Guide and a Multi-player program guide used for Games System herein.

Those skilled in the art will realise that a packet streamer is typically used to download new applications into the Games Consoles memory, thus making them resident applications.

Native applications 3 may be compiled in C or C++ using application program interfaces from the operating systems of the user devices such as Games Consoles and PC client terminals.
Native applications may include a HTML/Java Web Browser in which HTML and Java based user interfaces may be rendered.

In addition a HTML Engine sometimes referred to as a Middleware engine 2 may also reside on the users Games Console, PC or STB, as a native application that co-exists with other native applications. Through the Middleware engine the users device is operable to access applications provided via the in-band DTC or out-of-band FDC.

A HTML interpreter application resident on an STB, PC or Games Console is operable interpret specific HTML content used to define the parameters of a GUI and provide GUI functions. Those skilled in the art will realise that the HTML engine provides a STB direct access to content decoders for decompressing common JPEG images or AIFF audio. This is also same with a PC or Games Console.

It will appreciated that a number of computer languages could be used to create applications for a STB including Personnel Java (pJava) and Java Virtual Machine

(JVM) which would allow applications to be written in Java and downloaded into the STB flash memory. Further more through utilising pJava it is possible to use existing JavaTV libraries to access the STB TV related functionally such as channel switching. Java applications may of course co-exist with existing native and HTML based applications on the STB. Alternatively applications may be written in C or C++ and downloaded into the STB flash memory, Games Console or PC DRAM.

Referring to figure 1 the Operating System 5 provides the device specific software functionality of a subscriber's STB, Games Console or PC including network drivers, transfer protocols and hardware drivers. For example the TCP/IP Stack with the subscribers STB, Games Console or PC O/S provides the necessary protocols that enable the modem to receive and transmit data. These protocols maybe DVB or MCNS based.

Referring to figure 1 the sub-operating system 6 contains embedded device drivers that are specific to the subscriber's STB, Games Console or PC including Interface drivers, network drivers and peripheral drivers. For example a Games Console may include USB, Firewire and display drivers embedded in the devices memory. The sub-operating system may also include embedded interfaces built into the hardware or a controller board so that a device within the Games Console, STB or PC can be directly interfaced with system bus.

The software architecture described facilitates the means of providing game data over a DTC or FDC on a digital Satellite, Terrestrial or Cable TV network. The software architecture also provides the means enabling the Games System to utilise existing communication paths and infrastructure of a TV network as will be described.

Referring to Figure 2 the drawing, the Games Server consists of a five main software layers. These include an Application Specific Interface (ASI) 7, Application Program Interface (API) 8, Native Applications 9, Resident Application 10, Software Drivers 11 and an Operating System 12.

The Application Specific Interface (ASI) 7 enables the Game Server 12 to be interfaced with the Transport Network or Head-End. The ASI provides access to several different mechanisms and protocols for delivering data between the Game Server 12 and the Subscribers device regardless of whether a Games Console 15, PC or STB 13. In this way the Game Servers 12 are operable to be directly interfaced with a QAM Modulator 28, QPSK Modulator or a Broadband Integrated Gateway (BIG).

The Application Program Interface (API) 8 enables applications to be specifically coded for the Games Server from the operating system. The API also provides at set routines used by applications resident on the Games Server to direct performance procedures by the Operating System (O/S).

The Native Applications 9 are programs that have been designed specifically for the Games Servers Microprocessors. The programs are binary compatible with the

Microprocessor and therefore run much faster than non-native application, which must run with an emulator program. For example one native application on the Games Server 12 is an application streamer which operable to retrieve data from the memory resources of Games Server 12 and output the data within compressed MPEG-2 transport streams. The application streamer is also operable to combine video, audio and data for many of the games systems enhanced TV functionality. The application streamer may be configured to provided video, audio and data from multiple memory resources within MPEG transport streams in synchronisation.

It will be appreciated that the native applications may be compiled in C or C++ using application program interfaces from the operating systems of the Games Servers 12. Those skilled in the art will realise that a native server based application compiled in C may be designed for a Unix, Linux or Windows NT system.

Resident applications 10 are programs that remain loaded in the memory even when it is not running. This enables the application to be launched quickly for specific tasks while another application is running.

Referring to figure 2 the Operating System 11 provides the device specific software functionality of the Games Server 12 including network drivers, transfer protocols and hardware drivers. For example a TCP/IP Stack within Games Servers 12 O/S provides the necessary protocols that enable the Games Server to receive and transmit data. These protocols maybe DVB-MHP, DVB-S, DVB-T, DSM-CC, DVB-C, DOCSIS, EuroDOCSIS, DAVIC, MCNS, DVB-RCS, DVB-RCCL or DVB-RCT based.

The software architecture described facilitates the means of providing game data over a DTC or FDC on a digital Satellite, Terrestrial or Cable TV network. The software architecture also provides the means enabling the Games System to utilise existing communication paths and infrastructure of a TV network as will be described.

Referring to figure 3 the drawing, is an example an of a Cable TV architecture and infrastructure that may be used to distribute game data from the Game Servers 12 to a subscribers Games Console 15, PC 26 or STB 13.

Referring to figure 3 the cable TV content providers network consists of a Head-End/Data Centre, Transport Network infrastructure/backbone, Hub, Access Network and the subscriber's premises.

The Head-End provides the operational side of TV operator and may include several Game Servers 12, which are operable to output data continuously within the in-band forward path of a DTC or out-of-band FDC to all subscribers Games Consoles 15, PCs 26 or STBs 13. This is achieved through interfacing the Game Servers 12 with the Head-End network through a PCI System that may be Ethernet or Fiber.

The Game Servers 12 may also include an Application Specific Integration (ASI) interface that enables the Game Server 12 to be interfaced with the Transport Network

or Head-End. The ASI provides access to several different mechanisms and protocols for delivering data between the Game Server 12 and the Subscribers device regardless of whether a Games Console 15, PC or STB 13. In this way the Game Servers 12 are operable to be directly interfaced with a QAM/QPSK Modulator 28 or a Broadband Integrated Gateway (BIG).

Of course there is no reason why the Game Server 12 could not be located in the Hub 45 as illustrated in Patent GB 0203790.1, however as the Games System is designed to transport data through the use of in-band QAM Signals to a subscribers device and as such from an operational perceptive it is more cost advantageous to centrally situate the Game Servers 12 within the Head-End as illustrated in figure 3.

Referring to figure 3, the Head-End consists of a Games Servers 12 that are connected to an MPEG Encoder 31 which in turn is connected to a Multiplexer 30. In this way data transmitted by the Game Server 12 may be encoded into MPEG-2 transport streams by the Real-time MPEG Encoder 31, before being transmitted within a in-band QAM digital transmission channel (DTC) or out-of-band QPSK forward data channel (FDC).

The MPEG-2 Real-time Encoders (RTE) 31 are operable to compress video and data feeds into MPEG-2 transport streams which are then Multiplexed into a single signal by a Multiplexer 30 also located in the Head-End and transmitted to a subscribers device. It will be appreciated that the process of encoding data within an MPEG-2 transport stream may be achieved in real time.

Also connected to the MPEG Encoder 31 by fiber cable is the Advert insertion server 32, which provides QAM video content over in-band digital transmission channels (DTC). This may be interconnected with the Game Servers 12 for provisioning TV adverts within Graphical User Interface (GUI) provided by the Game System.

Connected to the Multiplexer 30 is Common QAM Content 29 storage from which TV program content may be retrieved and provided over an in-band DTC or analogue transmission channel (ATC).

Connected to the Multiplexer 30 is a Quadrature Amplitude Modulator (QAM) 28, which provides the in-band forward path for digital transmission channels (DTCs). A DTC is a QAM waveform with a bandwidth of 6 MHz used for transporting MPEG-2 Transport Streams from the Head-End to a users STB 13, Games Console 15 or PC 26.

The Head-End also contains a Middleware Server 35, which is operable to provide HTML, JavaScript and pJava objects to the subscribers STB 13, Games Console 15 or PC 26, which may be used to render a GUI.

It is also possible through HTML and JavaScript objects to command functionality on the device. For example through HTML objects it is possible to command the STB TV functionality such as switching the RF tuner to specific frequency to receive incoming data over an MPEG Stream.

As previously described a Middleware engine and HTML Browser resident within the Games Console 15, PC 26 or STB 13 enables HTML/JavaScript objects to be interpreted by the subscriber's device.

Connected to the Middleware Server 35 is a Command Server 38, which is operable to control data streams from the Game Servers 12. Monitoring software and diagnostics software provided on the Command Server 38 enables the TV operator to analysis bandwidth usage and identify problems such as bottlenecks within the network.

Also connected via a 10/100Base-t Ethernet network is a Billing Server 34, which is operable to provide transaction authentication and SSL. Connected to the Billing Server 34 is a Trivial File Transfer Protocol (TFTP) Server 33 which provides modem configuration files that may be used by the Games Console 15, PC or Set Top Box (STB) 13 equipped with Cable Modems 52 to access the Games System.

A Dynamic Host Configuration Protocol (DHCP) Server 37 provides dynamic assigned IP addresses to the subscribers Games Console 15, PC 26 or STB 13. The DHCP Server 37 also allows the re-use of assigned IP addresses.

A Domain Name System (DNS) Server 37 provides IP addresses to devices connected to the Games System such as the Game Servers 12 or Command Server 38. The DNS Server 37 may also be configured to provide addresses to subscribers and external network devices connected to Internet, enabling subscribers to access the devices external to the Cable TV network using TCP/IP.

A Time Of Day (TOD) Server 36 provides the synchronisation of native and resident applications on a subscribers device. For example the TOD Server 36 may be utilised to synchronise a program guide with the actual time.

The Middleware Server 35, Command Server 38, Billing Server 34, DHCP Server 37, TFTP Server 33 and TOD Server 36 are all connected via an 10/100Base-t Ethernet network to a Universal Broadband Router (UBR) 39 that connects the Head-End to the Transport Network infrastructure.

Also situated within the Head-End of the digital Cable TV Operator is Cable Modem Termination Systems (CMTS) 28 that is operable to modulate signals to a subscribers Cable Modem 16 and demodulate signals from a subscribers Cable Modem 16. The CMTS 28 controls and coordinators all data transmitted downstream to a subscribers Cable Modem 16. In addition the CMTS 28 may be configured to receive external data from other networks including the Internet. The CMTS 28 may also act as a server Dynamic Host Configuration Protocol (DHCP) Server, Time Of Day (TOD), Domain Name System (DNS) and provide device specific operating features for Cable modems.

Operation Support System (OSS) software within the Head-End provides Conditional Access (CAM). The hardware upon which the conditional access may be executed may

be a Sun Solaris or Windows NT based workstation that may also be the Billing Server 34.

A QAM Modulator 28 provides the in-band forward path for digital transmission channels (DTCs). A DTC is a QAM waveform with a bandwidth of 6 MHz used for transporting MPEG-2 Transport Streams from the Head-End to a subscribers STB 13, Games Console 15 or PC 26. The QAM modulator 28 also provides in-band Analogue transmission channels (ATCs). An ATC is an AM-VSB waveform and has a bandwidth of 6 MHz used for transporting an NTSC or PAL signals from the Head-End to a subscribers STB 13, Games Console 15 or PC 26.

Connected to the QAM modulator 28 is a Universal Broadband Router (UBR) 39 that connects the Head-End to the Transport Network infrastructure/backbone that provides the forward and reverse communication paths.

Referring to figure 3, the Transport Network 24 infrastructure/backbone consists of numerous Universal Broadband Routers (UBR) interconnected over fiber cabling. The Transport Network 24 infrastructure is operable to support the transmission of data, video and audio within in-band QAM Digital Transmission Channel (DTC) signals or the out-of-band QPSK Forward Data Channel (FDC) over a fiber based Transport Network 24 to the Hub 45.

Connected to the Transport Network 24 are Proxy Servers 40, 44 and Transcoder Servers 42. The Proxy Servers 40,44 provide HTTP links between the cable TV network and external networks such as the Internet. A Proxy Server 40 is operable to provide software objects to a subscriber's STB 13, Games Console 15 or PC 26. These objects may be HTML documents, Java applets or XML documents. A Proxy Server 40 may also provide filtering of requests, translation, and client authentication. A Proxy Server 40 typically uses an IP Gateway to distribute objects to a subscriber's STB 13, Games Console 15 or PC 26. These objects may be HTML or JavaScript objects or other applications.

The Transcoder Servers 42 provides the communication link between the Game Server 12 and subscribers device whether an STB 13, Games Console 15 or PC 26. The Transcoder Server is operable to convert RDC signals received from a DVB or MCNS Cable Modem 16 in to IP data packets, which may then transmitted over the Transport Network 24 to a Game Server 12, Middleware Server 35 or Proxy Server 40.

Referring to figure 3, within the Transport Network 24 fiber interconnects a UBR Router 39 with a second UBR Router 43 that connects to the Hub 45. The Hub 45 consists of Quadrature Phase Shift Keying (QPSK) Modulators 46 which provide the Forward Data Channel (FDC) used for transmitting data packets containing IP or MPEG-2 private sections to a subscriber's Games Console 15, PC 26 or STB 13.

The FDC is a QPSK waveform with a bandwidth of 1 MHz which may be used for transporting data and various subsystem components from the Hub to a subscribers Games Console 15, STB 13 or PC 26.

Fiber Nodes (FN) 51, alternatively referred to as Cable Nodes (CN), interconnect the Hub 45 with the Access Network 25 which in turn interconnects each subscribers Games Console 15, PC 26 or STB 13 via coaxial cable to the QPSK Modems 18 within the Hub 45.

The Access Network 25 often referred to, as the last five miles or the local loop, connects the Hub 45 to the subscribers STB 13, PC 26 or Games Console 15. For cable TV subscribers this is typically with coax via a cable modem (CM) to subscribers device as illustrated by figure 3, whereas with Satellite and Terrestrial TV subscribers this typically is via a dial up interface over ADSL/POTS exchange.

Referring to figure 3, the subscriber's premises includes a STB 13, PC 24 and a Games Console 15 that are connected to the Hub 45 via a cable modem/receiver 52. The Cable Modem 16 provides QPSK modulation and demodulation.

Referring to figure 3, the Games Console 15 consists of 120MB RAM 11, a 480MHz central processor unit (CPU), 32MB DRAM Memory, Digital Video Disc (DVD) Drive, a 3D Graphics Accelerator chip, Universal Serial Bus (USB) ports, a FireWire port, a 16MB Memory Card, an MPEG-2 decoder, and an Operating System (O/S).

The CPU is operable to interpret and execute instructions. The CPU is used to fetch, decode and to transfer data to and from resources. Data transferred between the Games Consoles 15 resources is transferred over the main data transfer path, the bus, which enables the CPU to command the Games Consoles 15 resources.

Random Access Memory (RAM) often referred to as the volatile memory is a semiconductor based memory that can be read and written by the CPU or other hardware devices. The CPU typically utilises the RAM when rendering a Game.

Dynamic RAM (DRAM) is a type of semiconductor random access memory which may be utilised by the CPU to store and retrieve data. DRAM is typically used during a game acting as a memory buffer with the RAM. Memory buffers hold data temporarily for processing allowing the CPU to access the data at a faster rate than on a DVD or hard disc. DRAM has the advantage of being able to store more data than RAM.

The memory card is a memory module containing random access memory (RAM) semiconductor chips that may be utilised by the CPU to store data or programs. The module may also comprise of EPROM, RAM, ROM or flash memory chips.

Digital Video Disc (DVD) drive is traditionally used by the Games Console 15 to access data, video and audio which has been encoded on a compact disc (CD). A DVD can store greater amounts of data than a traditional CD ranging from 4.7 GB to 17 GB.

The Graphics Card contains a coprocessor, which is a specialised microprocessor that can update graphics on a screen far quicker than a CPU can. The coprocessor is vital to performance of a Games Console 15 as it able to free up the CPU for other tasks. All present Games Consoles contain a Graphics coprocessor of some kind, which can generate polygons, texture maps, filters and lines in response to instructions from the CPU.

The FireWire (i-Link) port allows external devices to be connected to the Games console 15 such as a Hub, which enables multiple players to play against each other. The FireWire (i-Link) port will support data rates of up to 400 Mbps.

The MPEG decoder is operable to decode MPEG-2 streams received from a Satellite, Terrestrial or Cable TV signal. In this way video, audio and data compressed and digitised into an MPEG-2 transport stream and transmitted within an in-band DTC or out-of-band FDC signal can be decoded and interpreted by the CPU. It will be appreciated that the MPEG decoder may of course be software based or may form part of a Satellite, Terrestrial or Cable TV receiver.

The Universal Serial Bus (USB) ports enable external devices including Games Pads, Joysticks, Steering Wheels, Keyboards, Mousses, Modems and Network adapters to be connected to the Games Console 15.

The Games Console 15 may also include an optional Hard Disc or Optical Disc Drive on which games retrieved from a DTC or FDC may be stored. The Games console 15 is typically connected to users TV screen 14 via an AV lead to a TV Scart port or via S-video cable.

In figure 3, a Cable Modem 16 is illustrated external to a Games Console 15, however this may be internal to the device through an expansion bay as previously described. It will be appreciated that various different interfaces may be used to connect a Cable Modem 16 to a Games Console 15 including a USB, Firewire or Ethernet adapter.

Those skilled in the art will realise that the term modem is derivative to that of the term's modulation and demodulation. However the modems described herein are high-speed cable modems designed for high bandwidth data and video transmissions at bit rates of 4 to 19 Mbps and not 28.8 Kbps dial-up interface modems which most will be familiar with in terms of the Internet.

The Cable Modem 16 is operable to demodulator and modulate signals to and from a CMTS located within the Head-End. The Cable Modem 16 is also operable to retrieve data, video and audio transmitted within a FDC by QPSK Modulator located within the hub. The Cable Modem 16 may be connected to a Games Console via a type III PCMCIA Card slot within the expansion bay. It will be appreciated that various different Interfaces may be used to interface the Cable Modem 16 including Ethernet 10Base-T, RJ-45 connectors, USB Series B connector, Cable RF Input, 75 Ohm F-Connector.

Alternatively a 10/100 Base TX Ethernet card may be used to connect the Games Console 15 to the TV network and in turn the Games Server 12.

A QPSK demodulator within the users Cable Modem 16 is operable to receive IP packets and MPEG-2 private data sections. Using a QPSK demodulator the Cable Modem 16 is operable to receive data transmitted within a forward data channel (FDC) signal from the Games Server 12. A FDC is a QPSK waveform with a bandwidth of 1 MHz used for transmitting data to a subscriber's device from the Hub 45. A Cable Modem 16 typically utilises one FDC for receiving both application data and instructions at any given time.

A QPSK modulator within the subscriber's Cable Modem 16 provides an out-of-band Reverse Data Channel (RDC). The RDC is also a QPSK waveform with a bandwidth of 1 MHz used for transmitting data from a subscribers device to the Hub 45.

A Cable Modem 16 typically utilises one RDC for sending both application data and control messages at any given time. Those skilled in the art will realise that a Hub 45 may be configured to provide multiple RDC's to one Cable Modem 16 at any given time for providing data inputs and requests from the Games Console 15 to a Game Server 12.

A QAM demodulator within the subscribers Games Console 15 is operable to adapt to channels encoded at different rates of up to 56 Mbps. Thereby enabling data to be received at up to 56 Mbps. In this way data may be retrieved from a QAM in-band DTC signal at a bit rate of 45 Mbps which may be buffered into a Games Consoles 15 memory and rendered through utilising the Random Access Memory (RAM) 11. This is advantageous.

The Games Console 15 supports the key functions of, audio and video transport stream demultiplexing for cable broadcasts, source decoding, video encoding/transcoding, streaming audio and video, still imaging, return channel communications, home networking and storage. Software applications resident on the Games Console 15 facilitate the means of accessing game data over a DTC or FDC from the Cable TV network. The software drivers resident within the Operating System provides the means enabling the Games Console 15 to utilise existing communication paths and infrastructure of a TV network to transmit data upstream to the Games Server 12.

Connected by a s-video or AV lead to the subscribers Games Console 15 is a TV screen 14 that is operable to display video decoded by an MPEG decoder in the Games console and graphics rendered within the RAM. Alternatively the Games Console 15 may be connected via a S-VHS lead. The TV screen 14 includes speakers from which audio may be output.

Referring to figure 3, the Set Top Box (STB) 13 consists of an 80MHz Central Processor Unit, 4MB RAM, 2MB Flash Memory, 4MB DRAM, 256 KB EEPROM, 2

Smart card interfaces, 2 USB ports, a Graphics Processor Unit with 4MB SDRAM, an infra-red port, a built-in Modem, an MPEG decoder, an RF Tuner and software.

The CPU is a microprocessor which operable to interpret and execute instructions. The CPU is used to fetch, decode and to transfer data to and from the STB resources. Data is transferred over the STB's 13 main data transfer path, the bus, which enables the CPU to command the STB's 13 resources.

Random Access Memory (RAM) often referred to as the volatile memory is a semiconductor based memory that can be read and written by the CPU or other hardware devices. The CPU typically utilises the RAM when rendering a Game.

Flash Memory is a type of non-volatile memory is built into the STB 13. Flash memory is similar to EEPROM memory in function however data must be removed in blocks. The CPU utilises the flash memory to store data. In this way the Flash Memory acts as a replacement to a hard disc.

Dynamic RAM (DRAM) is a type of semiconductor random access memory which may be utilised by the CPU to store and retrieve data. The CPU utilises the DRAM as a memory buffer for game data. Memory buffers hold data temporarily for processing allowing the CPU to access the data at a faster rate than on a Flash Memory. DRAM has the advantage of being able to store more data than RAM.

Electrically Erasable Programmable read-only Memory (EEPROM) is a type of Erasable Programmable read-only Memory that can be erased with an electrical signal. EEPROM is typically used to store data for long periods without electricity while still allowing reprogramming. EEPROM has less memory than RAM and can only be reprogrammed a limited number of times before wearing out.

The Graphics Processor Unit (GPU) is a coprocessor, which is a specialised microprocessor that can update graphics on a screen far quicker than a CPU can. The coprocessor is vital to performance of a STB 13 as it able to free up the CPU for other tasks. The majority of present STBs contain a Graphics coprocessor of some kind, which can generate polygons, texture maps, filters and lines in response to instructions from the CPU.

The MPEG decoder is operable to decode MPEG-2 streams received from a Cable TV signal. In this way video, audio and data compressed and digitised into an MPEG-2 transport stream and transmitted within an in-band DTC or out-of-band FDC signal can be decoded and interpreted by the CPU. It will be appreciated that the MPEG decoder may of course be software based or may form part of a Satellite, Terrestrial or Cable TV receiver.

The remote control and Infra-red interface are standard in all current Set top boxes and are used to relay user commands to the Set top box 13. In this way the user is able to control a game through the manipulation of the buttons on the remote control.

The cable modem built in to the STB 13 enables QPSK Waveforms to be received and transmitted. Data may be transmitted through the QPSK modulator which enables the STB to utilise the Reverse Data Channel (RDC) with a QPSK waveform, which in turn provides a return path whereby requests and data inputs maybe transmitted upstream to a Game Server 12, Middleware Server 35 or Proxy Server 40. A QPSK demodulator enables the STB 13 to retrieve data within the out-of-band Forward Data Channel (FDC) provided by the Game Server 12, Middleware Server 35 or Proxy Server 40.

Those skilled in the art will realise that a QPSK Modulator typically located in the Hub 45 is operable to transmit packets containing IP or MPEG private sections over the FDC to the users STB 13. QPSK demodulators 46 present within the hub 45 enable data to be retrieved from the RDC and transported over the transport network to a Games Server 12, Middleware Server 35 or Proxy Server 40 within the Head-End.

A QAM demodulator within the STB 13 enables data to be retrieved from within QAM signal provided by the Game Server 12, Middleware Server 35 or Proxy Server 40. QAM signals are QAM waveforms which provides a forward path whereby data, audio and video maybe broadcast to all subscribers devices by a Game Server 12, Middleware Server 35 or Proxy Server 40 within a digital transmission channel (DTC).

It will be appreciated that various different protocol specifications may be used including DVB-C (Digital Video Broadcasting Cable), DVB-RCCL (Return Channel For Cable and LMDS), DAVIC (Digital Audio Visual Council) MCNS (Multimedia Cable Network System), IEEE 802.14, DOCSIS (Data-Over-Cable Service Interface Specification) to facilitate the transmission of data within the FDC or RDC.

The STB 13 supports the key functions of, audio and video transport stream demultiplexing for cable broadcasts, source decoding, video encoding/transcoding, streaming audio and video, still imaging, return channel communications, home networking and storage. Software applications provided on the STB 13 facilitates the means of accessing game data over a DTC or FDC from the Cable TV network. The software also provides the means enabling the STB to utilise existing communication paths and infrastructure of a TV network to transmit data upstream to the Games Server 12.

Connected Set Top Box (STB) 13 via a Scart lead is a TV screen 14 which is operable to display video decoded by a MPEG decoder in the STB 13 and graphics rendered by Graphic Processor Unit (GPU).

Referring to figure 3, the diagram shows a second subscriber that is connected to the access network via a cable modem 27 which in turn is connected to a Personnel Computer PC 26.

The Personnel Computer (PC) 26 contains a 1.2 GHz Central Processor Unit, 120MB RAM, 24MB DRAM, 32MB SDRAM, 512KB EEPROM, DVD Drive, 128MB 3D Graphics

Accelerator chip, a 40 Gigabyte Hard Disc, an PS2 port, a Modem/receiver, a MPEG-2 decoder and an Operating System (O/S).

The CPU is a silicon based microprocessor which operable to interpret and execute instructions. The CPU is used to fetch, decode and to transfer data to and from resources. Data is transferred over the PC's 26 main data transfer path, the bus, which enables the CPU to command the PC's 26 resources.

Random Access Memory (RAM) often referred to as the volatile memory is a semiconductor based memory that can be read and written by the CPU or other hardware devices. The CPU typically utilises the RAM when rendering a Game.

Dynamic RAM (DRAM) Is a type of semiconductor random access memory which may be utilized by the CPU to store and retrieve data. The CPU utilises the DRAM as a memory buffer for game data. Memory buffers hold data temporarily for processing allowing the CPU to access the data at a faster rate than on a DVD or hard disc. DRAM has the advantage of being able to store more data than RAM.

Electrically Erasable Programmable read-only Memory (EEPROM) is a type of Erasable Programmable read-only Memory that can be erased with an electrical signal. EEPROM is typically used to store data for long periods without electricity while still allowing reprogramming. EEPROM has less memory than RAM and can only be reprogrammed a limited number of times before wearing out.

Digital Video Disc (DVD) drive is traditionally used by the PC 26 to access data, video and audio which has been encoded on a compact disc (CD). A DVD can store greater amounts of data than a traditional CD ranging from 4.7 GB to 17 GB.

The Graphics Card contains a coprocessor, which is a specialised microprocessor that can update graphics on a screen far quicker than a CPU can. The coprocessor is vital to performance of a PC 26 as it able to free up the CPU for other tasks. The majority of present PCs contain a Graphics coprocessor of some kind, which can generate polygons, texture maps, filters and lines in response to instructions from the CPU.

The MPEG decoder is operable to decode MPEG-2 streams received from a Cable TV signal. In this way video, audio and data compressed and digitised into an MPEG-2 transport stream and transmitted within an in-band DTC or out-of-band FDC signal can be decoded and interpreted by the PC 26. The MPEG decoder may be connected to the PC 26 via a PCI slot. It will be appreciated that the MPEG decoder 45 may of course be software based or may form part of a Cable receiver.

The PS2 interface is standard on all PCs and enables the user to command a game using a keyboard or mouse. In this way the user is able to control a game through manipulating the buttons on the keyboard or mouse, which may be interpreted by a game engine on the PC 26 and the corresponding graphics to users inputs are

rendered on the screen. With present PC systems this process can be performed in real time.

According to the present invention subscribers of Cable TV may be provided with USB adapter. The USB would enable a PC 26 to be indirectly interfaced via a USB interface to a DVB-C or MCNS based Cable modem that is operable to connect to the Game Server 12.

According to yet a further aspect of the present invention a PC 26 may be directly interfaced to the Game Server 12 situated with the Head-End via a Cable Modem 27. The Cable Modem 27 may be connected to a PC 26 via an expansion bay. Alternatively an Ethernet Network Card 10/100Base-t may be used to connect the PC 26 to the Games Server 12.

In this way a PC 26 may access data within the in-band and out-band signals provided by the Games Server 12. In addition through the Cable Modem 27 the PC 26 may transmit requests or data via the reverse data channel (RDC) upstream to the Game Server 12 with the Head-End. This is advantageous.

The PC 26 supports the key functions of, audio and video transport stream demultiplexing for cable broadcasts, source decoding, video encoding/transcoding, streaming audio and video, still imaging, return channel communications, home networking and storage. Software applications provided on the PC facilitate the means of accessing game data over a DTC or FDC from the Cable TV network. The software also provides the means enabling the PC to utilise existing communication paths and infrastructure of a TV network to transmit data upstream to the Games Server 12.

Referring to figure 3, according to the present invention means may be provided whereby a subscriber may trigger a game to download directly relating to video preview of a game provided on a digital transmission channel (DTC) or an analogue transmission channel (ATC) using a Games Console, PC or STB.

For example a subscriber may be watching a video preview of a game provided on a DTC by the Games Server 12 or QAM Content Servers 29 in which HTML/JavaScript or C++ objects containing triggers are transmitted to the subscriber's Games Console 15. The CPU in the Games Console 15 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image which is displayed in the top right corner of the TV screen prompting the subscriber to download a game.

Through manipulating the buttons on the Games Pad the subscriber may respond to the prompt. If the subscriber responds by pressing the select button on Games Pad then a signal is then transmitted to the CPU in the Games Console 15. Through software provided on the Games Console 15 the CPU interprets the data input signal and instructs the Cable Modem/receiver connected via PCMCIA slot to switch channels to correct MPEG packet ID (PID) required for the game. The cable modem then

performs a handshake with the CMTS 28 situated at the Head-End. This is needed to agree on how to transmit/receive game data and is based on a protocol that defines the type of signalling, frequencies used and authentication.

The game data, which is being transmitted continuously by the Games Server 12 within a DTC, is then received via the HFC and demodulated by the Cable Modem/receiver. An MPEG Decoder in the Games Console 15 is then operable to decompress and decode the digitised data stream provided within an MPEG-2 transport stream.

The CPU then buffers the data onto the Games Console 15 Dynamic Random Access Memory (DRAM) and the game is rendered using the RAM. The rendered graphics are then output from the Games Console 15 via an AV-video lead which is connected to a TV Screen 14 upon which the game is displayed. Through manipulating the buttons on the Games Pad the subscriber is operable to control the game. This is advantageous.

Referring to figure 3, according to yet a further aspect of the present invention subscribers may be provided with a user interface from which the subscriber may select and download games to a STB, Games Console or PC. This is achieved through transmitting HTML/Java data in the DTC, in-band Forward Path, or an out-of-band forward data channel (FDC) to a subscribers STB 13, Games Console 15 or PC 26.

For example a subscriber may be watching a video preview of a game provided on a DTC by the Games Server 12 or QAM Content Servers 29. Within the data stream of the DTC HTML/JavaScript or C++ objects containing triggers are transmitted to the subscriber's Games Console 15. Using the Middleware engine the Games Console 15 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen prompting the subscriber to access the games by pressing select button on the game pad.

If the subscriber responds by pressing the select button on the game pad a signal is then transmitted to the CPU of Games Console 15. Through software provided on the Games Console 15 the CPU is operable to interpret the subscribers data input. The CPU then launches a resident application which is operable retrieve HTML, JavaScript or C++ data from the DTC which is temporally stored in the Dynamic Random Access Memory (DRAM) of the subscriber's Games Console 15.

Using a Middleware engine resident on the Games Console 15 is operable to render the user interface (UI) using the HTML, JavaScript or C++ objects provided by a Games Server 12, Middleware Server 35 or Proxy Server 40. Those skilled in the art will realise that the UI is typically realised within the RAM of the Games Console 15.

Preferably video previews of games available may be provided within the user interface. This is achieved through overlaying HTML, Jpeg and GIF graphics provided within the data stream on MPEG video received within the in-band DTC signal. The video may be defined within HTML parameters of the user interface.

The subscriber is then able to navigate user interface by manipulating the buttons on the game pad, which is may be interpreted by the CPU and which in turn highlights the subscriber's selection. The subscriber then presses the select button on games pad, which sends a signal to the CPU in Games Console 15. The CPU is operable to interpret the subscribers data input and instructs the Cable Modem/receiver 52 to switch to the correct Channel ID, Service ID and Packet Identity (PID) relating to game selected. The Cable modem/receiver 52 then performs a handshake with the CMTS 28 situated at the Head-End. This is needed to agree on how to transmit/receive game data and is based on a protocol that defines the type of signalling, frequencies and authentication used. For example this protocol may be DVB-C or MCNS based.

Authentication is provided through the conditional access system that provides a link from the subscriber's device back to the service provider Head-End so that a viewing history can be obtained by the Billing Server 34 for billing purposes. The conditional access system enables the subscriber to utilise pay-per-play services provided by the Games Server 12. The conditional access system is typically provided through a multi-step encryption/decryption scheme. The steps could include DES, RSA and digital signature algorithms.

The conditional access system also provides information that restricts the receiving party to only access games content which it is authorised to view or have agreed to pay for. The conditional access system could also be configured for copy control to prevent taping with games, a regional control may be used to blackout specific regions and a user control for parental control of games.

Once the subscriber is authenticated and the receiving protocol is defined data may then received by the Cable modem/receiver 52. The Cable Modem/receiver 52 then receives data output by the Games Server 12 within the DTC as MPEG TS via the Transport network 14 and Access Network 25. Through an application the Games Console 15 is operable retrieve the data from Cable modem/receiver 52 which is then buffered in to the DRAM of the Games Console 15 from which the game may be rendered.

Those skilled in the art will realise that a game is typically realised within the RAM of a Games Console 15. In this way the subscriber may visually select a game from a user interface by highlighting a game of their choice using a games pad and download the game on to the Games Console 15 memory from which the game may be played. This is advantageous.

Referring to figure 3, according to yet a further aspect of the present invention game data required by a games console, PC or STB may be stored on the Games server 12 and transmitted continuously or on demand to specific user. This is achieved through interfacing the Game Servers 12 with a QAM Modulator, at the Head-End.

For example the Games Server 12 situated within the Head-End may be configured to output game data stored on a hard disc, optical disc, DVD or disk array continuously to as a raw data stream to an Real Time MPEG Encoder (RTE) 31. The RTE is operable to compress and encode the data provided by Games Server 12 into separate MPEG Transport streams that are the multiplexed and combined into single channel by a Multiplexer 30. The channel is then modulated by a QAM modulator 28 within 256 QAM waveform which provides a data throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction and I=128, J=1-4 Interleaving provided, 6 MHz carrier, 44 MHz IF, 52 db SNR.

The QAM signal is then transmitted to a Universal Broadband Router (UBR) 39 that is operable to route the QAM signal over the Transport Network to a second UBR 43. The QAM signal is then transmitted from the second UBR 43 to the Hub 45, which is in turn is then transmitted via the Fiber Nodes 51 over the Access Network 25 to all subscribers tuned into the channel upon which the game data is provided.

For example a subscriber may be watching a video previews of games provided on a separate DTC by the Games Server 12 or QAM Content Servers 29. Within the data stream of the DTC HTML/JavaScript or C++ objects containing triggers are transmitted to the subscriber's Games Console 15. Using the Middleware engine the Games Console 15 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen prompting the subscriber to access the games by pressing select button on the game pad.

If the subscriber responds by pressing the select button on the game pad a signal is then transmitted to the CPU of Games Console 15. Through software provided on the Games Console 15 the CPU is operable to interpret the data input. The CPU then launches a resident application which operable retrieve HTML, JavaScript or C++ data from the DTC which is then temporally stored in the Dynamic Random Access Memory (DRAM) of the subscriber's Games Console 15.

Using a Middleware engine the Games Console 15 is operable to render the user interface (UI) using the HTML, JavaScript or C++ objects provided by a Games Server 12, Middleware Server 35 or Proxy Server 40. Those skilled in the art will realise that the UI is typically realised within the RAM of the Games Console 15.

The subscriber is then able to navigate user interface by manipulating the buttons on the game pad, which is then interpreted by the CPU and the corresponding selection to subscriber's inputs are highlighted on UI which is displayed on the TV Screen 14. The subscriber is then able to select and highlight a game of their choice using the games pad.

The subscriber then selects a game by highlighting a game of their choice and pressing the select button. The CPU then interprets the data input and instructs the DVB-C Cable modem/receiver 52 to switch to correct channel and transport stream identifiable

within the PID, SID and Channel ID. The Cable modem/receiver 52 then performs a handshake with the CMTS 28 situated at the Head-End. This is needed to agree on how to transmit/receive game data based on a protocol that defines the type of signalling, frequencies used and authentication.

The QAM signal is then received by the DVB-C Cable modem/receiver 52 that is connected to the Games Console 15 via the USB port. The Cable modem/receiver 52 is operable to demodulator the QAM signal and data stream is separated from audio and video signals. The data signal is then transferred to the MPEG decoder that decodes the data back to its original form and the data is then buffered into DRAM from which the game may be rendered.

Using the random access memory the CPU then renders the Game which is then output from the Games Console 15 via an Audio and Video lead which is connected to a via TV Scart adapter to the TV Screen 14 upon which the rendered games graphics are displayed. Through manipulating the buttons on the Games Pad the subscriber is operable to control the game. This is advantageous.

In this way games which are output by the Games Server 12 to a QAM Modulator 28 maybe transmitted continuously over a DTC from which games maybe downloaded via a user interface onto a Games Console 15, PC 26 or STB 13 at anytime. It will be appreciated that through providing game data over a DTC or ATC the games are being transmitted as a broadcast, which may be incepted by anyone with a receiver that is tuned into the right channel signal. Those skilled in the art will realise that a channel is a separate incoming QAM signal or ATC source that a subscriber can select through a RF tuner. As such the signal has a defined bandwidth with of 6 to 8MHz that may be utilised to provide games to a subscribers Games Console 15, PC 26 or STB 13 equipped with a DVB-C Cable Modem/receiver. Typically a channel will exist within a range of 50-850MHz.

It will be appreciated that all DTC or ATC have bandwidth and that the amount of bandwidth required is only proportional to the size of a game and not the number of users. In a traditional Internet system bandwidth is directly proportional to amount of data transmitted and the numbers of users. This is disadvantageous. It will also be appreciated that through transmitting the game data continuously within a DTC as broadcast only one copy of a game is required to be stored on a Games Server 12. This is advantageous.

According to yet a further aspect of present invention means may be provided whereby up to 20 MPEG-2 transport streams containing game data may be aggregated into one 256-QAM Digital Transmission channel, which may be provided continuously over a Broadcast File System (BFS). This is achieved through combining multiple MPEG-2 data transport streams in to a signal 256-QAM Waveform that may be broadcast to all viewers over a Cable TV network.

It will be appreciated that this may be scaled to suit the TV operator's requirements whereby up 200 MPEG-2 transport streams each containing a different game may be provided continuously over multiple QAM channels. This is advantageous.

Referring to figure 3, according to yet a further aspect of the present invention game data that is stored on the Game Server 12 Storage Subsystem may be transmitted over a variety of links to a subscribers Games Console 15, PC 26 or STB 13. These may include Cable TV Networks Transmissions, IP, IPv6 or Ethernet.

Those skilled in the art will realise that a data transmission may be provided over a simplex or full duplex (using an interaction channel for the return) and may be Unicast (point-to-point), Multicast (one to many) or broadcast (all receivers receiving the assigned PID).

Referring to figure 3, according to yet a further aspect of the present invention there are five main methods of providing game data within a DTC or FDC to a users Games Console, PC or STB which consist of Data Piping, Data Streaming, Data Carousels or Object Carousels.

Data Piping is a method used by the Games Server 12 to deliver discrete pieces of game data using containers to the destination. Those skilled in the art will realise that typically there is no timing relationship between other (PES) packets and the game data packets.

Data Streaming is a method used by the Game Server 12 to provide game data, which takes the form of a continuous stream that is carried in an asynchronous PES.

Data Carousels is a method that may be used by the Game Server for assembling game data sets into a buffer, which are played-out cyclic manner (periodic transmission). The data sets may be of any format or type i.e. HTML, Java or C++. For example this technique may be used to provide the data for an onscreen On-line Games Guide. The data may be transmitted using fixed sized DSM-CC sections.

A yet further method that may be used by the Game Server 12 to transport data is referred to as an Object Carousel. Object carousels typically resemble data carousels, however they are primarily intended for the broadcast of data services. Those skilled in the art will realise that the data sets are typically defined by the DVB Network Independent Protocol specification and may be used, to down-load data to a Games Console, PC or STB.

Referring to figure 3, the Cable TV operator network uses a Broadcast File System (BFS) for transporting data repeatedly over the network. This enables the TV operator to provide data such as EPG listings continuously to an STB. Through the present invention the BFS allows a Games Console 15, PC 26 or STB 13 to quickly access games at anytime without requiring the use of an RDC to request data from the Game Server 12. This mechanism is useful where large numbers of subscribers require the

same game data. An example would be where the same game is made available to any Games Console that has access to the DTC or FDC. This is advantageous.

It will be appreciated that a number of different transport protocols may be used to transmit data over the Transport network to the STB 13, Games console 15 or PC 26 such as Schedule Transfer (ST), TCP/IP, RTSP and IPTV. Through utilising transport protocols such as ST this provides an optimal data output suitable to transmit game data over TV operators network or a DTC.

Through continuously outputting data from the Game Server 12 over the BFS a subscriber may access and begin to download a game at any point of the data cast regardless of when the user triggers the download. Any data provided within the BFS that is transmitted via in-band QAM or out-of-band QPSK signals may be accessed through a data stream manager resident on the users STB 13, Games Console 15 or PC 26 which is activated on users request.

The data stream manager is a resident application on the user STB 13, Games Consoles 15 or PC 26 that enables game data to be retrieved and interpreted from the BFS into the device DRAM or Flash memory where it is then rendered on a TV Screen. Those skilled in the art will realise that a game is typically realised in the RAM of a device.

For example referring to figure 3, An application resident on the Games Server 12 is operable retrieve the game data, audio and video that is stored within the Games Server Sub storage system. The data, audio and video is then output via an AM Fiber Transport Network or SONET/SDH Transport Network interface to the MPEG Encoder. The MPEG Encoder then encoders the data, audio and video into separate elementary streams that are then combined to form individual MPEG Transport Streams. During this process each MPEG TS is assigned a unique PID that is identifiable with a particular game provided within the games systems user interface or channels.

The signal is output from the MPEG Encoder 31 as MPEG TS to a Multiplexer 30 that combines the MPEG TS with other incoming signals using Time Divisional Multiplexing TDM and Frequency Divisional Multiplexing (FDM) techniques. The signal is then output from the Multiplexer 30 to a QAM Modulator 28, which modulates the multiplexed signal within a 256 QAM waveform (Digital Transmission Channel). The Digital Transmission Channel (DTC) provides a total throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction and I=128, J=1-4 Interleaving provided, 6 MHz carrier, 44 MHz IF, 52 db SNR.

The QAM signal is then transmitted to a Universal Broadband Router (UBR) 39 that operable to forward the QAM signal over the Transport Network to a second UBR 43. The QAM signal is then transmitted from the second UBR 43 to the Hub 45, which is in turn is then transmitted via the Fiber Nodes 51 over the Access Network 25 to the subscribers DVB-C Cable Modem/Receiver. The QAM signal is then demultiplexed and demodulated by the Cable Modem/Receiver. The MPEG TS signals are then separated

into data, audio, video and ????. The audio and video elementary streams are then buffered in the decoders memory for playback and the data stream is then decoded into its original data form and buffered into the Games Consoles 15 Dynamic Random Access Memory (DRAM).

In this way the TV operator is only required to provide one 2Mbps MPEG-2 Transport streams per game as opposed to per user to their total subscriber base. For example using the present invention described in the TV operator could provide a 2Mbps MPEG 2 stream over a cable transmission link to all subscribers from which a game could be retrieved on to a STB, Games Console or PC at anytime. This is achieved through transmitting data that is retrieved from the Games Server sub storage system and provided continuously over a digital transmission channel. This eliminates the need for a dial up connection and provides a low cost yet high-bandwidth delivery of games to subscribers. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a user is not required to download an entire game to play. Through BFS a Games Console 15 or PC 26 are operable to access data just as they would from a CD or DVD whereby only the data required for the game level is loaded into the memory. In this way the subscribers does not have to download the entire game onto a hard disc or Personal Video Recorder (PVR) to be played.

Similar to a DVD or CD games system the Games Console 15 or PC 26 will only load what is required from BFS, which is provided continuously within a DTC or FDC. Those skilled in the art will realise that a game is typically realised within the RAM or a Games Console 15 or PC 26.

In this way the BFS acts as storage for all games each with a unique PID identifiable within a unique MPEG-2 Stream that is provided continuously over a FDC or DTC. This is advantageous. This may also applied to STB as it has limited storage capacity

Through utilising the BFS data may be retrieved and rendered by a Games Console 15, PC 26 or STB 13 without requiring a hard disc, optical disc drive or removable storage. This is achieved through buffering data into DRAM of Games Console 15, PC 26 or STB 13. From which the CPU is operable is render the game through utilising the RAM. As the subscriber progresses through the game, data is retrieved from the DTC or FDC, which is similar to a DVD or CD usage in a Games Console. Each game is designed to retrieve data from the BFS on instruction which links to specific PID relating to the Game data required.

This removes the necessity for storage capacity on the users device as all the game data may be stored and retrieved from within BFS, which is provided continuously over a DTC or FDC to a users device.

Alternatively the subscriber may be equipped with hard disc which can be utilised by the CPU to store game data retrieved from the BFS. Thereby enabling games to be stored locally on the subscribers Games Console 15, PC 26 or STB 13.

As will be appreciated various formats may be used to transport the game data including MPEG-4, DigiCipher II and Raw Transport Data (RTD). Preferably though an MPEG-2 format is used to transport the game data to a user's device. This has the advantage of being supported by mostly all digital TV operators.

According to yet a further aspect of the present invention a subscriber's STB 13, Games Console 15 or PC 26 is operable to retrieve raw data sent in MPEG-2 private sections. This is achieved through transmitting data and video over the same transport stream or when a Games Server 12 does not utilise the BFS. An application resident within the users STB 13, Games Console 15 or PC 26 enables data to be interpreted and a game to be rendered on the users TV screen. In this way the user is able to retrieve data within the MPEG transport stream that can be interpreted by a Games Console, STB or PC to render the game which is the output from the subscribers Games Console, STB and displayed on a TV screen or SVGA for PCs.

The STB 13, Games Console 15 or PC 26 is operable to access data within the MPEG-2 data stream through an utilisation the stream manager a resident application that ensures that the device is tuned into the correct frequency and PID of the game requested by the user.

Referring to figure 3, according to yet a further aspect of the present invention means may be provided whereby software drivers may be provided to Games Consoles 15, PC 26 or STB 13 via a digital transmission channel (DTC). In this way when a user accesses a digital transmission channel the necessary software drivers to play a game may be provided directly to viewers Games Console 15, PC 26 or STB 13 which may be provided over a DTC or FDC and stored as resident applications. For example the drivers may include a graphics engine required to render games available on the games system. This is advantageous.

Alternatively means may be provided whereby a user can select and download drivers from GUI. These drivers may be specific to a device that may be connected to viewers Games Console 15, PC 26 or STB 13 to play a game such as an Infrared or USB Games Pad.

Referring to figure 3, according to yet a further aspect of the present invention means may be provided through a GUI whereby a user can select and download multiple games at same time on to a Games Console 15, PC 26 or STB 13. The data may be stored on a hard disc, personnel video recorder (PVR) or a secondary memory device connected via a USB or Firewire port to a Games Console 15, PC 26 or STB 13. In this way a subscriber may store games locally on their device. This is advantageous.

This is achieved through aggregating several MPEG-2 transport streams each containing data relating to a specific game within one in-band 8 MHz 256-QAM signal. Within one 8 MHz 256-QAM signal there is a maximum of 56 Mbps total data throughput in which each game may be provided within 8 Mbps MPEG-2 streams simultaneously. The user may therefore download up to four games at a rate of 8 Mbps from a single DTC. At a low rate of 3 Mbps allocated to each game up to 18 games may be downloaded at the same time over a single DTC. However at a low rate of 3Mbps the games would take noticeably longer to download.

For example if each game is 600MB then with a 12 Mbps connection this would take approximately 50 seconds to download one game multiplied by 4 this would take 3 minutes and 33 seconds approximately. Whereas with a 3 Mbps connection this would take 3 minute and 20 seconds per game which multiplied by 18 would take approximately 58 minutes.

Alternatively multiple games may be retrieved from an out-of-band QPSK signal which set at 6 MHz would provide a total throughput of 36 Mbps in which several games could be provided. For example means may be provided whereby a subscriber may prompt a GUI provided within a DTC which would enable them to select and highlight multiple games which may be provided over a QPSK signal to a Games Console, STB or PC. Preferably previews of the games may be broadcast or streamed within the GUI thereby enabling the subscriber to preview a game before downloading. This is advantageous.

According to yet a further aspect of the present invention the Command Server 38 is operable to vary the rate of the transport streams in relation to size of game. The rate may be adjusted from 512 Kbps up to 56 Mbps per game within an 8Mhz QAM Waveform. This is advantageous.

Referring to figure 3, according to yet a further aspect of the present invention means may be provided whereby a game that a Games Server 12 has provided that to a subscribers Set Top Box (STB) 13 over a DTC or FDC may be saved. This may provided in number of ways. Firstly means may be provided whereby a Game may saved within the flash memory of a STB 13 as a resident application from which the subscriber may select and load a game from the point the game was saved. This is advantageous.

For example when a game is saved data is stored on the STB 13 flash memory containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID (PID), service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 and Time stamp that links to specific section of a game.

A resident application on STB 13 is operable to interpret the Game identifier stored in the STB flash memory and search for a specific PID, Channel ID and Time Stamp relating to the saved game. Once the correct PID and Channel ID is established data is then retrieved from the in-band DTC or out-of-band FDC via a Cable Modem/receiver to the STB 13 and stored in the flash memory or dynamic random access memory (DRAM). The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively a game may be saved on a USB memory card connected to the STB 13 via the USB port. A resident application on the STB 13 would enable a subscriber to save and load saved games stored on the USB memory card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the USB memory card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams (TS) carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 that links to specific section of a game. For example a PID may include the value 40 which is identifiable with a specific data packet provided within an MPEG TS that relates to the particular level that the game was saved.

A resident application on STB 13 is operable to interpret the PID on the USB memory card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band DTC or out-of-band FDC via a Cable Modem/receiver to the STB 13 and buffed in the flash memory or dynamic random access memory. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a STB 13 on a Smart card which may be inserted in a smart card drive. The majority of Set-Top Boxes are equipped with multiple smart card drives, which are presently used for conditional access and authentication. Within the Smart card flash memory, EEPROM or DRAM a games could be saved. A resident application on the STB 13 would enable a subscriber to save and load saved games stored on the Smart card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the Smart card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 that links to specific section of a game. For example a PID may include the value 40 which is identifiable with a specific

data packet provided within an MPEG TS that relates to the particular level that the game was saved.

A resident application on STB 13 is operable to interpret the PID on the Smart card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band DTC or out-of-band FDC to the STB 13 and stored in the flash memory or DRAM. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively means may be provided through a resident application on the STB 13 would enable a subscriber to save and load saved games stored on hard disc or a Personal Video Recorder (PVR). In this way a subscriber may select and load a game from the point the game was saved. Through utilising a hard disc or a Personal Video Recorder (PVR) a subscriber would be able to save a significant number of games. This is advantageous.

When a game is saved data is stored on a hard disc or a Personal Video Recorder (PVR) containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 and Time stamp that links to specific section of a game. For example a PID may include the value 40 which is identifiable with a specific data packet provided within an MPEG TS that relates to the particular level that the game was saved.

A resident application on STB 13 is operable to interpret the PID, Channel ID and Time stamp on the hard disc or PVR and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the DTC or FDC to the STB 13 and stored in the flash memory, hard disc or within the memory on the PVR. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a STB 13 on a Games Server 12 which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a DTC or FDC which would enable a game to be saved on the Games Server 12. When a game is saved data is stored on Games Server containing a Game ID and Subscriber ID. The Game Identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID (PID), Time Stamp, Service ID, publisher, developer, format and size.

Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game ID also contains a unique value at the end of the PID that links to specific section of a game within a PID ranging from 0 to 255. A

resident application on the STB 13 enables a subscriber to select and load a game from the point the game was saved on the Games Server 12 using the data stored in Game Identifier.

For example, referring to figure 3, a subscriber may be watching a video preview of a game provided on a DTC by the Games Server 12 or QAM Content Servers 29. Within the data stream of the DTC HTML/JavaScript or C++ objects containing triggers are transmitted to the subscriber's STB 13. Using the Middleware engine the STB 13 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen 14 prompting the subscriber to access the games by pressing the red button on the remote control.

If the subscriber responds by pressing the select button on the remote control a signal is then transmitted to the CPU of STB 13. Through software provided on the STB 13 the CPU is operable to interpret the subscribers data input. The CPU then launches a resident application which is operable retrieve HTML, JavaScript or C++ data from the DTC which is temporally stored in the Dynamic Random Access Memory (DRAM) of the subscriber's STB 13.

Using a Middleware engine resident on the STB 13 the CPU is operable to render the user interface (UI) using the HTML, JavaScript or C++ objects provided by a Games Server 12, Middleware Server 35 or Proxy Server 40. Those skilled in the art will realise that the UI is typically realised within the RAM of the STB 13.

Preferably video previews of games available may be provided within the user interface. This is achieved through overlaying HTML, Jpeg and GIF graphics provided within the data stream on MPEG video received within the in-band DTC signal. The video may be defined within HTML parameters of the user interface.

The subscriber is then able to navigate the user interface by manipulating the buttons on the remote control, which is may be interpreted by the CPU and which in turn highlights the subscriber's selection. Preferably the subscriber is provided the option to select saved games via the remote control.

A resident application on STB is operable to retrieve the PID from the Games Server by constructing a request in response to the subscriber's inputs on the remote control. If the subscribers selects saved games a request formed by the STB 13 which is transmitted upstream by the Cable Modem/Receiver within a 1MHz QPSK waveform, Reverse Data Channel (RDC), to the Hub 45. QPSK Modems 46 within the Hub 45 are operable to retransmit the data stream to a Universal Broadband Router (UBR) router 43 situated on the Transport Network. The UBR router 43 is operable to route the data stream to second UBR router 39 that is connected to the Games Server 12 situated at the Head-End via an Ethernet 10/100base-t connection.

The Games Server 12 is operable to retrieve the saved games using the Subscribers ID from a database situated in Head-End and transmit the Game identifier files which are encoded within a MPEG-2 transport stream by an MPEG Encoder 31 as private MPEG section only accessible by authenticated subscriber. The digitised signal is then combined with other data, video and audio streams output by the Games Servers 12 and multiplexed by Multiplexer 30 into a single signal using Time Divisional Multiplexing and Frequency Divisional Multiplexing techniques.

The multiplexed signal is then modulated by the QAM/QPSK modulator 28 into an in-band QAM or out-of-band QPSK waveform. The signal containing the subscribers saved game data is then transmitted downstream via a UBR router 39 over the Transport network 24 to a second UBR router 43 which is operable to route the transmission via the Hub 45 downstream over the Access Network to the subscribers STB 13. A Cable Modem/receiver within the STB 13 then demultiplexes and demodulates the incoming signal that is then feed to an MPEG decoder/processor in the STB 13. The MPEG decoder/processor in the STB 13 then decodes the MPEG stream and data is decoded into its original form. The CPU then buffers the data into the flash memory or dynamic random access memory (DRAM).

Using HTML/JavaScript data that is provided with the MPEG-2 private transport stream the STB 13 is operable to render a second user interface using the RAM. The subscriber is then presented with list of saved games within the second user interface. Each saved game listed within the user interface has a unique PID, Channel ID and Service ID stored temporally within the STB 13 memory.

Using the PID, Time Stamp and Channel ID provided within the saved game data through a resident application the CPU is operable to identify and instruct the Cable Modem/receiver to the correct MPEG transport stream containing the exact data relating to the subscriber selection of a saved game. Upon the subscriber's input the game data is then retrieved by Cable Modem/receiver from the DTC or FDC and buffered into the flash memory or dynamic random access memory of the STB 13.

Using the random access memory the STB 13 is operable to render the game which is then output from the STB 13 via a TV Scart as an analogue signal and displayed on the TV Screen 14. Through manipulating the buttons on the remote control the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively a saved game executable file may be stored within the STBs flash memory, DRAM or EEPROM as an instruction which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the flash memory, DRAM or EEPROM that may be provided within a user interface of a Game.

For example a subscriber might select a game from the DTC by pressing the red button on their remote control. The game data is then retrieved from the data stream and buffered in to the Set Top Box 13 flash memory or DRAM and realised within the RAM. When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen 14 that is connected to the STB 13 via a Scart lead.

Within the user interface an option to load a game option may be provided. Using the remote control the subscriber may select the load game option. The game then constructs a request that is interpreted by the STB 13 Central Processor Unit (CPU) which is operable to retrieve game data stored within the STB memory resources. The saved game files are then provided within a second user interface as a list of saved games. Through manipulating the buttons on the remote control the subscriber may select a saved game to load. If the subscriber presses select then using the data stored on STB 13 memory resources the game is loaded and the subscriber is able to play the game from the point the game was saved. This is advantageous.

It will be appreciated that the saved game data stored on the STB 13 flash memory, DRAM or EEPROM may contain Game identifiers which as previously described may be used retrieve data stored within the BFS using the PID, Channel ID, Time Stamp and Service ID. This may be necessary for the user to continue playing a game from the point the game was saved depending on the actual byte size of the game.

According to yet a further aspect of the present invention means may be provided whereby a game that a Games Server 12 has provided to a subscribers Games Console 15 over a DTC or FDC may be saved. This may provided in number of ways. Firstly means may be provided whereby a Game may be saved within the memory card of a Games Console 15 as a resident application from which the subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the Games Console 15 memory card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, Packet ID (PID), publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique value and time stamp that links to specific section of a game. For example a PID may include the number 7 which is identifiable with specific data packet provided in the BFS that links to level 12 of a game.

A resident application on Games Console 15 is operable to interpret the PID, Channel ID and Time Stamp on the memory card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band DTC or out-of-band FDC via a Cable Modem/receiver to the Games Console 15 and buffered in the DRAM memory. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively a game may be saved on a USB memory card connected to the Games Console 15 via the USB port. A resident application on the Games Console would enable a subscriber to save and load saved games stored on the USB memory card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the USB memory card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique value ranging from 0 - 255 and a Time stamp that links to specific section of a game.

A resident application on Games Console 15 is operable to interpret the PID, Channel ID, Time Stamp and Service ID on the USB memory card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band DTC or out-of-band FDC to the Games Console 15 and buffered in the DRAM memory. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby through a resident application on the Games Console 15 this would enable a subscriber to save and load saved games stored on Hard disc or an Optical Disc Drive. In this way a subscriber may select and load a game from the point the game was saved. Through utilising a Hard disc or a Optical Disc Drive a subscriber would be able to save a significant number of games. This is advantageous.

When a game is saved data is stored on a Hard disc or a Optical Disc Drive containing a Game Identifier (GID). The GID contains attributes of the game including, title, time of transmission, channel frequency, channel number, publisher, developer, format and size. The Game Identifier also includes specific Packet Identifier (PID)

Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique number that links to specific section of a game. For example a PID may include the number 7 which is identifiable with the level of a game.

A resident application on Games Console 15 is operable to interpret the GID on the Hard disc or Optical Disc Drive and search for a specific PID, Service ID and Channel ID relating to the saved game. Once the correct PID, Service ID and Channel ID is established data is then retrieved from the DTC to the Games Console 15 and stored in the Dynamic Random Access Memory, Hard disc or Optical Disc Drive. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a Games Console 15 on a Games Server 12 which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a DTC which would enable a game to saved on the Games Server 12.

A resident application on the Games Console 15 would enable a subscriber to select and load a game from the point the game was saved on the Games Server 12. This may be achieved in a number of ways. Firstly a request may formed by the subscribers Games Console 15 and transmitted upstream via the RDC to Games Server 12 which is operable to retrieve the saved games from a database situated in Head-End and transmit the saved files via the FDC to the subscribers Games Console 15. Once received by the Games Console 15 a game may be loaded.

When a game is saved data is stored on Games Server 12 containing a Game identifier (GID) and Subscriber ID. The GID contains attributes of the game including, title, time of transmission, channel frequency, channel number, MPEG TS identifier, Packet identifier (PID), publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The GID also contains a unique number at the end of the data string that links to specific section of a game. For example a GID may include a 07 at the end of the address which is identifiable with the level 7 of a game.

A resident application on Games Console 15 is operable to retrieve the PID from the Games Server 12 by constructing a request which is transmitted upstream within a QPSK waveform. The Game Server 12 is operable to interpret the request and using the subscribers ID retrieves the subscribers saved games from a database which is then transmitted of FDC or DTC to the subscribers Games Console 15.

For example, referring to figure 3, a subscriber may be watching a video preview of a game provided on a DTC by the Games Server 12 or QAM Content Servers 29. Within the data stream of the DTC HTML/JavaScript or C++ objects containing triggers are transmitted to the subscriber's Games Console 15. Using the Middleware engine the Games Console 15 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen 14 prompting the subscriber to access the games by pressing the select button on a game pad.

If the subscriber responds by pressing the select button on the game pad a signal is then transmitted to the CPU of Games Console 15. Through software provided on the Games Console 15 the CPU is operable to interpret the subscribers data input. The CPU then launches a resident application which is operable retrieve HTML, JavaScript or C++ data from the DTC which is temporally stored in the Dynamic Random Access Memory (DRAM) of the subscriber's Games Console 15.

Using a Middleware engine resident on the Games Console 15 the CPU is operable to render the user interface (UI) using the HTML, JavaScript or C++ objects provided by a Games Server 12, Middleware Server 35 or Proxy Server 40. Those skilled in the art will realise that the UI is typically realised within the RAM of the Games Console 15.

Preferably video previews of games available may be provided within the user interface. This is achieved through overlaying HTML, Jpeg and GIF graphics provided within the data stream on MPEG video received within the in-band DTC signal. The video may be defined within HTML parameters of the user interface.

The subscriber is then able to navigate the user interface by manipulating the buttons on the games pad, which is may be interpreted by the CPU and which in turn highlights the subscriber's selection. Preferably the subscriber is provided the option to select saved games via the games pad.

A resident application on Games Console 15 is operable to retrieve the PID from the Games Server 12 by constructing a request in response to the subscriber's inputs on the remote control. If the subscribers selects saved games a request formed by the Games Console 15 which is transmitted upstream by the Cable Modem/Receiver within a 1MHz QPSK waveform, Reverse Data Channel (RDC), to the Hub 45. QPSK Modems 46 within the Hub 45 are operable to retransmit the data stream to a Universal Broadband Router (UBR) router 43 situated on the Transport Network. The UBR router 43 is operable to route the data stream to second UBR router 39 that is connected to the Games Server 12 situated at the Head-End via an Ethernet 10/100base-t connection.

The Games Server 12 is operable to retrieve the saved games using the Subscribers ID from a database situated in Head-End and transmit the Game identifier files which are encoded within a MPEG-2 transport stream by an MPEG Encoder 31 as private MPEG section only accessible by authenticated subscriber. The digitised signal is then combined with other data, video and audio streams output by the Games Servers 12 and multiplexed by Multiplexer 30 into a single signal using Time Divisional Multiplexing and Frequency Divisional Multiplexing techniques.

The multiplexed signal is then modulated by the QAM/QPSK modulator 28 into an in-band QAM or out-of-band QPSK waveform. The signal containing the subscribers saved game data is then transmitted downstream via a UBR router 39 over the Transport network 24 to a second UBR router 43 which is operable to route the transmission via the Hub 45 downstream over the Access Network to the subscribers Games Console 15.

A Cable Modem/receiver 16 within the Games Console 15 then demultiplexes and demodulates the incoming signal that is then feed to an MPEG decoder/processor in the Games Console 15. The MPEG decoder/processor in the Games Console 15 then

decodes the MPEG stream and data is decoded into its original form. The CPU then buffers the data into the dynamic random access memory (DRAM).

Using HTML/JavaScript data that is provided with the MPEG-2 private transport stream the Games Console 15 is operable to render a second user interface using the RAM. The subscriber is then presented with list of saved games within the second user interface. Each saved game listed within the user interface has a unique PID, Channel ID and Service ID stored temporally within the Games Console 15 memory.

Using the PID, Time Stamp and Channel ID provided within the saved game data through a resident application the CPU is operable to identify and instruct the Cable Modem/receiver to the correct MPEG transport stream containing the exact data relating to the subscriber selection of a saved game. Upon the subscriber's input the game data is then retrieved by Cable Modem/receiver 16 from the DTC or FDC and buffered into the dynamic random access memory of the Games Console 15.

Using the random access memory the Games Console 15 is operable to render the game which is then output from the Games Console 15 via a S-Video lead as an analogue signal and displayed on the TV Screen 14. Through manipulating the buttons on the games pad the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively a saved game executable file may be stored within the Games Console 15 memory card or EEPROM as an instruction which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the memory card or EEPROM that may be provided within a user interface of a Game.

For example a subscriber might select a game from the DTC by pressing the select button on their games controller pad. The game data is then retrieved from the data stream provided within the DTC and buffered in to the Games Console 15 dynamic random access memory (DRAM) and realised within the RAM.

When the game is launched an introductory user interface which may comprise or C+ or HTML/JavaScript objects is presented to the subscriber on the TV screen that is connected to the Games Console 15 via a S-video lead. Within the user interface an option to load a game option may be provided.

Using the games controller pad the subscriber may select the load game option. The game then constructs a request, which is interpreted by the Games Consoles 15 Central Processor Unit (CPU) which is operable to retrieve game data stored within the Games Console 15 memory resources. The saved game files are then provided within a second user interface as a list of saved games. Through manipulating the buttons on the remote the subscriber may select a saved game to load. If the subscriber presses select then using the data stored on memory resources and the Games Consoles 15

RAM the CPU loads the game and the subscriber is able to play the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a game that a Games Server has provided that to a subscribers Personal Computer (PC) 26 over a DTC or FDC may be saved. This may provided in number of ways. Firstly through a resident application on the PC 26 this would enable a subscriber to save and load saved games stored on hard disc or an Optical Disc Drive. In this way a subscriber may select and load a game from the point the game was saved. Through utilising a Hard disc or a Optical Disc Drive a subscriber would be able to save a significant number of games. This is advantageous.

When a game is saved data is stored on a hard disc or an Optical Disc Drive containing a Game identifier (GID). The GID contains attributes of the game including, PID, title, time of transmission, channel frequency, channel number, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The GID also contains a unique value that links to specific section of a game. For example a GID may include the number 7 which is identifiable with level 7 of a game.

A resident application on PC 26 is operable to interpret the PID on the Hard disc or Optical Disc Drive and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the DTC to the PC 26 and stored in the flash memory, Hard disc or Optical Disc Drive. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a PC 26 on a Games Server 12 which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a DTC or FDC which would enable a game to saved on the Games Server 12. A resident application on the PC 26 would enable a subscriber to select and load a game from the point the game was saved on the Games Server 12. This may be achieved in a number of ways. Firstly a request may formed by the subscribers PC 26 and transmitted upstream via the RDC to Games Server 12 which is operable to retrieve the saved games from a database situated in Head-End and transmit the saved files via the FDC to the subscribers PC 26. Once received by the PC 28 a game may be loaded.

When a game is saved data is stored on Games Server 12 containing a Program ID (PID) and Subscriber ID. The PID contains attributes of the game including, title, time of transmission, channel frequency, channel number, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique number at the end of the data string that links to specific section of a game. For example a PID may include a 07 at the end of the address which is identifiable with the level of a game.

A resident application stored on the PC 26 is operable to retrieve the PID from the Games Server 12 by constructing a request which is transmitted upstream within a QPSK waveform. The Game server 12 is operable to interpret the request and using the subscribers ID retrieves the subscribers saved games from a database which is then transmitted of FDC or DTC to the subscribers PC 26. The resident application then interprets the PID and searches for the specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band DTC or out-of-band FDC to the PC 26 and buffered in the DRAM memory or stored on hard disc. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively a saved game executable file may be stored within the PC 26 hard disc or EEPROM as an instruction which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the hard disc or EEPROM that may be provided within a user interface of a Game.

For example a subscriber might select a game from the DTC by pressing the select button on their keyboard or games pad. The game data is then retrieved from the data stream and buffered in to the PC's 26 dynamic random access memory (DRAM) and realised within the RAM. When the game is launched an introductory user interface, that may comprise or C+ or HTML/JavaScript objects, is presented to the subscriber on the SVGA screen that is connected to the PC 26.

Within the user interface an option to load a game option may be provided. Using the games controller pad the subscriber may select the load game option. The game then constructs a request, which is interpreted by the PC's 26 Central Processor Unit (CPU) which is operable to retrieve game data stored within the PC 26 memory resources. The saved game files are then provided within a second user interface as a list of saved games. Through manipulating the buttons on the remote the subscriber may select a saved game to load. If the subscriber presses select then using the data stored on memory resources and the PC 26 RAM the CPU loads the game and the subscriber is able to play the game from the point the game was saved. This is advantageous.

Referring to figure 3, according to yet a further aspect of the present invention means may be provided whereby through a user interface provided within an in-band DTC or out-of-band FDC a user can select multi-player networked games using a STB, Games Console or PC and play against other subscribers.

For example, referring to figure 3, a subscriber might access a GUI from an in-band DTC by pressing the select button on a Games Pad. Data containing HTML and JavaScript objects is then retrieved from the DTC to the Games Consoles 15 memory. Using the HTML and JavaScript objects the Games Console 15 is operable to render

the GUI. Those skilled in the art will realise that a GUI is typically realised within the RAM of a Games Console 15.

Within the GUI the subscriber is presented with a list of multi-player networked games including details of number of players, duration of play, game in session, difficulty level, author, publisher and channel.

Preferably MPEG 1 video previews of live multi-player networked games in session may be provided within the user interface. This is achieved by using data inputs retrieved from participating subscribers Games Console, STB or PC within RDC to render the games graphics on Game Server 12 situated in Head-End as described previously in GB 0129161.6.

Through manipulating the buttons on the Games Pad the subscriber may highlight and select a multi-player networked game to join in. If the subscriber selects a game then a resident application on the Games console 15 switches the Cable modem/receiver 16 to the correct DTC or FDC relating to the games PID. Data is then retrieved from the DTC or FDC via the Cable modem/receiver 16 on to Games Console 15 DRAM. The game is then realised within the RAM.

A two-way communication path is then established between the Games Server 12 and Games Console 15 enabling data inputs to be exchange. It will be appreciated that the two-way communication may be formed by two cable modems performing a handshake and using QPSK modulation to transmit data upstream to Games Server 12 and downstream to the Games Console 15.

Data inputs are then provided to the Games Server 12 within a 1MHz QPSK Waveform initiated by the DVB-C receiver/modem. This provides an Reverse Data Channel (RDC), often referred to as the return path, in which data inputs may be transmitted upstream to a Games Server 12.

Data inputs are then centrally exchanged via the Games Server 12 and each participating subscriber's Games console, PC or STB. Using the Data provided by the Games Server 12 via an in-band DTC signal or out-of-band FDC the Games console is operable to render the game. In this way a subscriber may select and join in a Multi-player network game from GUI provided over an in-band DTC or out-of-band FDC. This is advantageous.

It will be appreciated that this method of providing multi-player networked games may be provided to any Cable TV subscriber with a Games Console, STB or PC equipped with a Cable Modem/receiver capable of transmitting and receiving data provided over at out-of-band FDC or in-band DTC. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby sound and music output from the Games Server 12 may be provided by as MPEG audio stream to enhance the user interfaces of a game. It will be appreciated

that this may be provided within an in-band digital transmission channel (DTC) or out-of-band forward data channel (FDC).

In this way music or sounds may provided as a signal which may decoded by a receiver within STB 13 and output from a Television set 14 internal or external speakers.

For example, referring to figure 3, a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB 13. The STB 13 Central Processor Unit then interprets the signal and transmits an instruction to the Cable Modem/receiver that is operable to retrieve data, audio and video from the DTC relating to the Packet Identifier (PID) of the game that was selected. The data is then retrieved from the DTC and buffered into the STB flash memory or DRAM and rendered within the Random Access Memory.

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen 14 that is connected to the STB 13 via a Scart lead. Software on the subscribers STB 13 is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the DTC which may include an instruction to decode one or more MPEG audio streams in whilst the UI is displayed on the TV screen 14.

Using the PID provided in data instructions the CPU is operable to instruct the Cable Modem/receiver to switch over the correct MPEG audio stream required. Receiver switches MPEG audio streams and audio is buffered into the MPEG decoder memory. The MPEG decoder then decodes the MPEG audio into an analogue signal that is then output from the subscriber's Television 14 speakers.

In this way music and audio relating to the games UI may then be heard. This enhances the game menus by integrating sound and music without requiring the data to downloaded and stored on the STB 13 flash memory. In addition as the audio or music is provided as MPEG audio stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the audio or music is provided as MPEG audio stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

Of course this may also be used for other applications or user interfaces not relating games including banking, e-mail, electronic program guides, betting and shopping. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby video provided by the Games Server within an in-band digital transmission channel (DTC) or out-of-band forward data channel (FDC) is combined with data stream at the Head-End and transmitted to a subscribers STB.

At the subscribers STB the CPU use HTML/JavaScript or C+ objects and the STB RAM to render a game's user interfaces or menus. The user interface is then rendered over video which has been decoded by an MPEG decoder in the STB. In this way video, audio and images may be provided to enhance the UI of a game and enable motion backgrounds. Audio as previously described may also be decoded by a receiver within STB and output from a television's internal or external speakers.

For example a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB. The STB Central Processor Unit then interprets the signal and transmits an instruction to the modem/receiver that is operable to retrieve data, audio and video from the DTC relating to the Packet ID of the game that was selected. Data, video and audio are then retrieved from the DTC. The data is then buffered into the STB flash memory and the game is rendered within the random access memory (RAM).

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen that is connected to the STB via a Scart lead. Software on the subscribers STB is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the DTC which may include an instruction to decode one or more MPEG video streams whilst the UI is displayed on the TV screen.

An MPEG decoder in the STB is operable to decode the MPEG video provided over the DTC that is then output from the subscriber's television screen. Video relating to the games UI may then be seen in behind the game's menu. This enhances the game menus by integrating video without requiring the data to downloaded and stored on the STB flash memory. In addition as the video is provided as MPEG transport stream and decoded by MPEG decoder this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data required to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilized to provide other services. In addition as the video is provided as MPEG transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

Of course this may also be used for other applications or user interfaces not relating games including banking, e-mail, electronic program guides, betting and shopping. This is advantageous

According to yet a further aspect of the present invention music and audio affects during a game may be provided over an in-band QAM Signal or out-of-band QPSK Signal. It will be appreciated that multiple audio formats may be used by the Game Server to provide sound and music including Dolby Digital Surround Sound, MPEG 1 Layer 3 (MP3) and Audio Compression Level 3 (AC-3).

Through utilising in-band DTC or out-of-band FDC to provide music and audio during a game this reduces processing requirement, which is of particular advantage to a STB that has very little processing capabilities. This is advantageous.

This may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. This is advantageous.

According to yet a further aspect of present invention means may be provided whereby video provided over a in-band digital transmission channel (DTC) is utilised within a game as part games graphics. For example the foreground may be provided over DTC as a data stream and rendered by a STB, Games Console or PC over the video provided within the QAM Signal. Combined with the foreground graphics this then enhances the game quality and reduces the required data to be processed by a STB, Games Console or PC.

According to yet a further aspect of the present invention video provided within in-band DTC and combined with the foreground graphics may be rendered graphics by the Games Server. For example using a graphics engine on the Games Server a games background may be rendered and provided as MPEG video which is then output by the server and combined with data stream by a Multiplexer into a 6 MHz QAM signal which is transmitted to the subscribers STB. It will be appreciated that this may be transmitted via cable, satellite or terrestrial communication paths as previously described in GB 0129161.6 and GB 0203790.1. Within the subscribers STB a MPEG decoder is operable to decode the video stream which is then output on TV screen. Using data also provided within QAM signal and the STB's random access memory, the CPU is operable to render the game's foreground graphics over the video. In this way the STB is not required to render the games background thereby reducing the number of processing transaction required of the CPU and RAM. Through rendering graphics on Games Server the graphics provided during a game can be enhanced to that equal to or greater than current Games console system. This is advantageous.

Additionally through freeing up the CPU and RAM this enables more enhanced graphics to be rendered by the STB including polygons, texture maps and simple 3D objects. This is advantageous. It will be appreciated that the background graphics provided by the Games Server may be pre-rendered thereby not requiring the Games server to render the games background. This is advantageous. In this way the STB, Games Console or PC are not required to process the background data as this is provided as a transmission within a QAM Signal. This is advantageous

Alternatively the background graphics may be provided over an Analogue Transmission Signal (ATC) with Raw Data or transmitted within the out-of-band FDC with compressed digitised data.

According to yet a further aspect of present invention means may be provided whereby video provided over a forward data channel (FDC) is utilised within a game as part games graphics. For example the foreground may be provided over DTC or FDC and rendered by STB, Games Console, PC however video within the FDC QPSK Signal may be utilised as the game background. Combined with the foreground graphics this then enhances the game quality and reduces the required data to be processed by a STB, Games Console or PC.

According to yet a further aspect of the present invention video provided within out-of-band FDC and combined with the foreground graphics may be rendered graphics by the Games Server. For example using a graphics engine on the Games Server a games background may be rendered and provided as MPEG video which is then output by the server and combined with data stream by a Multiplexer into a 6 MHz QPSK signal which is transmitted to the subscribers STB. It will be appreciated that this may be transmitted via cable, satellite or terrestrial communication paths as previously described in GB 0129161.6 and GB 0203790.1. Within the subscribers STB a MPEG decoder is operable to decode the video stream which is then output on TV screen. Using data also provided within QPSK or QAM signal and the STB's random access memory, the CPU is operable to render the game's foreground graphics over the video. In this way the STB is not required to render the games background thereby reducing the number of processing transaction required of the CPU and RAM. Through rendering graphics on Games Server the graphics provided during a game can be enhanced to that equal to or greater than current Games console system. This is advantageous.

Additionally through freeing up the CPU and RAM this enables more enhanced graphics to be rendered by the STB 13 including polygons, texture maps and simple 3D objects. This is advantageous. It will be appreciated that the background graphics provided by the Games Server 12 may be pre-rendered thereby not requiring the Games server 12 to render the games background. This is advantageous. In this way the STB, Games Console or PC are not required to process the background data as this is provided as a transmission within a QPSK Signal. This is advantageous

According to yet a further aspect of the present invention means may be provided whereby video provided over a in-band digital transmission channel (DTC) is utilised within a game to provide full motion cut scenes.

For example a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB 13. The STB 13 Central Processor Unit then interprets the signal and

transmits an instruction to the modem/receiver that is operable to retrieve data, audio and video from the DTC relating to the Packet Identifier (PID) of the game that was selected. Data, video and audio are then retrieved from the DTC. The data is then buffered into the STB flash memory and the game is rendered within the random access memory (RAM).

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen that is connected to the STB 13 via a Scart lead. Software on the subscribers STB 13 is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the DTC which may include an instruction to decode one or more MPEG video streams when the subscriber selects play.

An MPEG decoder in the STB 13 is operable to decode the MPEG video provided over the DTC that is then output from the subscriber's television screen. Video relating to the games may then be played on the subscriber's TV screen and subscribers views a video cut scene for the game. This enhances the game by integrating video without requiring the video to downloaded and stored on the STB 13 memory. In addition as the video is provided as MPEG transport stream and decoded by MPEG decoder this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data required to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the video is provided as MPEG transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

According to yet a further aspect of the present invention video output by the Game Server may be provided within a QAM Signal of a Digital Transmission Channel, which may be provided as continuous loop of video whereby random cut scenes are provided when a game is loading between levels.

Alternatively through aggregating several or more 3Mb/s MPEG-2 streams in to a single DTC it is possible to provide non-random cut scenes that are linked to users progress during a game. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby video provided over a out-of-band forward data channel (FDC) is utilised within a game to provide full motion cut scenes. For example a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB 13. The STB 13 Central Processor Unit then interprets the signal and transmits an instruction to the modem/receiver that is operable to retrieve data, audio and video from the FDC relating to the Packet Identifier (PID) of the game that was selected. Data, video and audio are

then retrieved from the FDC. The data is then buffered into the STB 13 flash memory and the game is rendered within the random access memory (RAM).

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen that is connected to the STB via a Scart lead. Software on the subscribers STB 13 is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the DTC which may include an instruction to decode one or more MPEG video streams when the subscriber selects play.

An MPEG decoder in the STB 13 is operable to decode the MPEG video provided over the DTC that is then output from the subscriber's television screen. Video relating to the games may then be played on the subscriber's TV screen and subscribers views a video cut scene for the game. This enhances the game by integrating video without requiring the video to downloaded and stored on the STB 13 flash memory. In addition as the video is provided as MPEG transport stream and decoded by MPEG decoder this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data required to be downloaded to a users Games Console 15 or PC 26 and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the video is provided as MPEG transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

According to yet a further aspect of the present invention video output by the Game Server may be provided within a QAM Signal of a Digital Transmission Channel, which may be provided as continuous loop of video whereby random cut scenes are provided when a game is loading between levels.

Alternatively through aggregating several or more 3Mb/s MPEG-2 streams in to a single 6MHz QPSK FDC it is possible to provide non-random cut scenes that are linked to users progress during a game as will be described. This is advantageous.

Referring to figure 3, according to yet a further aspect of the present invention means may be provided whereby the subscriber's Cable modem/receiver is operable to switch audio streams on command during a game. Through Channel identifiers, MPEG Transport Stream (TS) Identifiers the subscriber Cable modem/receiver is also operable to switch DTC, FDC or MPEG TS on command during a game.

It will be appreciated that multiple audio streams may be provided by the Games Server 12 within MPEG Transport streams that may be aggregated into a single DTC or FDC from which the subscriber's receiver is operable to switch between audio streams during a game. This may be achieved through instructions or triggers provided within game data stream or script that provide unique Packet Identities that may be

interpreted by the subscriber's receiver that is operable to switch to the correct audio stream provided within DTC or FDC using the Packet identifier (PID).

Alternatively through the use of Program Association Tables the subscribers receiver may be instructed during duration play to switch streams to specific PID. This may be applied to scripted or non-scripted games engine.

For a subscriber's STB, Games Console or PC to receive a particular transport stream, the subscriber's device must first determine the PID being used and then filter packets that have a matching PID value. To help the STB, Games Console or PC identify which PID corresponds to which game, a special set of streams, referred to as Signalling Tables, are transmitted with a description of each game carried within the MPEG-2 Transport Stream.

Signalling tables are sent separately to PES, and are not synchronised with the elementary streams. For example they may be provided through an independent channel. The Program Specific Information (PSI) table in MPEG-2 consists of a description of the elementary streams which need to be combined to build games, and a description of the games.

Each Digital Transmission Channel may contain up to 17 MPEG Transport Streams (TS) with a bit rate of 2Mbps that are aggregated into a single 6MHz in-band QAM signal. Equally each Forward Data Channel may also contain up to 17 Transport Streams (TS) provided at rate of 2Mbps that are aggregated into a single 6MHz out-of-band QPSK signal.

Each MPEG Transport Stream (TS) is unique to each game that is provided by the Games Server 12. Each transport stream consists of several or more elementary streams (ES) that may include Digital Control Data, Digital Audio (sampled and compressed), Digital Video (sampled and compressed) and Digital Data (synchronous, or asynchronous). Each ES provided within MPEG TS can be assigned a unique value from 1 to 255, which are utilised by the subscribers Games Console, PC or STB to identify streams relating to a particular game. It will be appreciated that various Audio samples ranging from sample rates of 16Bps to 365 Kbps may be encoded as elementary steams that are provided with MPEG TS.

Through utilising data triggers within games may utilises bandwidth within a DTC or FDC without requiring to download an entire games data. This is advantageous. Additionally through providing audio within MPEG TS this frees up the CPU within subscribers Games Console, STB or PC to carry out other tasks such as rendering a 3D object. This is advantageous.

For example, referring to figure 3, using remote control the subscriber prompts a game from a digital transmission channel. IR signal transmitted to STB IR port. The CPU interprets instruction and an Instructs the Cable modem/receiver switch PID to correct MPEG TS relating to the game selected. Data is then retrieved from the MPEG TS and

buffered within Dynamic Random Access Memory (DRAM) or Flash Memory of the STB 13.

The CPU then renders the games using Random Access Memory (RAM) that is then feed from the STB 13 via a Scart lead to TV Screen 14. Audio is then buffered into the memory of the MPEG decoder, which operable to demultiplex and demodulate the signal that is then output from the STB 13 via a Scart lead to the TV speakers. The rendered graphics are then displayed on the subscriber's TV screen 14 and audio is then output through TV speakers. As previously described through manipulating the buttons on the remote control the subscriber is operable to control the game.

During the game an instruction is provided within data stream to switch audio streams to a new PID. The CPU interprets the instruction and instructs the receiver/decoder to switch audio streams to correct PID. The receiver the switches PID audio that is then decoded and output from speakers.

Prior to transportation over a DTC or FDC each ES is input to an MPEG-2 processor, often referred to as a video compressor or encoder, which accumulates the data into a stream of Packetised Elementary Stream (PES) packets. A PES packet may be a fixed or variable sized block, with up to 65536 bytes per block and includes a 6 byte protocol header. The PES protocol header consists of a 3-byte start code followed by a 1-byte stream ID and a 2-byte length field.

Within each MPEG ES additional information about the stream is also provided to assist the decoder at the receiver. This includes a Packetised Elementary Stream (PES) Scrambling Control that defines whether scrambling is used, and the chosen scrambling method, a PES Priority that indicates priority of the current PES packet and a data alignment indicator that indicates if the payload starts with a video or audio start code. Other additional information may include copyright information, indicating if the game within payload is copyright protected. The ES may also include information on whether the ES is an original or a copy of the original ES.

Within each MPEG ES additional information about the stream is also provided to assist the decoder at the receiver. This includes a Packetised Elementary Stream (PES) Scrambling Control that defines whether scrambling is used, and the chosen scrambling method, a PES Priority that indicates priority of the current PES packet and a data alignment indicator that indicates if the payload starts with a video or audio start code. Other additional information may include copyright information, indicating if the game within payload is copyright protected. The ES may also include information on whether the ES is an original or a copy of the original ES.

The ES are then combined within MPEG TS before being transported to the Multiplexer 87.
multiplexed by Multiplexer 66 into a single signal using Time Divisional Multiplexing and Frequency Divisional Multiplexing techniques.

The QAM modulator 68 then modulates the channel within 256 QAM waveform. This provides a data throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction. Once the forward error correction is complete the QAM signal containing the subscribers saved game data is then transmitted to a DBS Satellite Uplink 67. DBS Satellite Uplink 67 is operable to transmit the QAM signal to a DBS Satellite 84. The DBS Satellite 84. then amplifies the signal that is then transmitted to all subscribers with Satellite Receivers within the Satellites Spot beam.

The signal is then received by the Satellite Receiver 81 and feed into the Satellite Modem/receiver within the STB 13, which then demultiplexes and demodulates the incoming signal that is then feed to an MPEG decoder/processor in the STB 13. The MPEG decoder/processor in the STB 13 then decodes the MPEG stream relating to PID requested during the game. This is advantageous.

It will be appreciated that the elementary streams may synchronised, or may not be synchronised depending on the task required. For example elementary streams are usually synchronised for digital TV programs, or for digital radio programs to ensure that the audio playback is in synchronism with the corresponding video frames. However the elementary streams may be not synchronised to facilitate the downloading of software or games via a televised program. Those skilled in the art will realise that the subscribers STB, Games Console or PC receiver may achieve synchronisation through utilising time stamps that are provided within the MPEG transport stream.

According to yet a further aspect of the present invention means may be provided whereby remote co processing and assistance graphic processing is provided by the Games Server to enhance 3D and 2D graphics within a game. This is achieved by using data inputs provided by a subscriber's Games Console, PC or STB for the Games Server to render a game.

For example, referring to figure 3, a user may prompt a game from a user interface using the Games Pad. The Cable Modem/receiver then performs a handshake with a Cable Modem Termination Unit (CMTS) 28 situated in the Head-end. This may be DVB-C or MCNS based. A two-way communication is then established with the subscribers Games Console Cable Modem/receiver and Games Servers 12 Cable Modem. The two-way communication consists of a Forward Path or Forward Data Channel (FDC) and an Reverse Data Channel (RDC).

The Game is then executed on the Games Server 12 and a resident application is launched that enables the user's data inputs to be interpreted by the Games Server 12 Central Processor Unit (CPU). A graphics processor card within the Games Server is operable to output RGB, PAL, NTSC or composite signals from the Games Server 12 to an MPEG encoder 31.

An application resident on the Games Console 15 is operable instruct CPU to transmit users data inputs within RDC which may received by the Games Servers 12 situated that are operable to interpret the users data inputs and render 3D/2D graphics.

Rendered graphics are then output from Games Server 12 graphics card as RGB, PAL, NTSC or composite signal to an MPEG real time encoder (RTE) 31 and encoded and compressed within an MPEG 2 video transport stream in real time. The digital signal is the multiplexed within an in-band Forward Path or out-of-band Forward Data Channel (FDC) by a Multiplexer 30, using Time Divisional Multiplexing (TDM) and Frequency Division Multiplexing (FDM). The signal is modulated into a QPSK waveform or QAM waveform depending on whether the signal is transmitted within a in-band forward path as private MPEG stream or within an out-of-band FDC.

The signal is then transmitted over the Cable TV operators transport network 14 that consists of a series of Universal Broadband Routers (URB) 39,43 connected over Fiber optic cables to the hub 45 where signal is then transmitted over Access Network 25 to subscribers Cable Modem 16.

Signal is then demultiplexed, demodulated by the Cable Modem/receiver 16 before being buffered into the memory of an MPEG decoder in the Games Console 15 for playback. The signal is the decoded by the MPEG decoder and output from Games Console 15 via a AV lead to TV screen 14.

Through manipulating the buttons on the games pad the user is able to control the game. The data inputs are continuously transmitted within a RDC via the Cable Modem 16 to Games Server 12 that is operable to render the game. The rendered graphics are the received within an in-band DTC or out-of-band FDC and displayed on the user TV screen 14.

In this way the entire game may be rendered by the Games Server 12 or partially rendered which enables far more complex and detailed 3D scenes to be rendered during a game than supported by a STB, Games Console or PC to be rendered within a game. This is advantageous.

It will be appreciated that the any modem for example a 28 Kbps or 56 Kbps modem may be used by a Games Console, PC or STB to transmit data inputs upstream via return path to Games Server 12 and that any 28 kbps to a 56 kbps modem may be used by the Games Server 12 to receive data inputs.

Figure 4 is an example of a Direct Broadcast Satellite (DBS) system and Satellite TV network architecture which may be used to connect a subscribers Games Console, STB or PC to the Games System. Direct Broadcast Satellite (DBS) system is an alternative to cable television as a digital telecommunications service that provides television programming and data via a Digital Satellite System.

Referring to figure 4 the satellite TV content providers network consists of a Head-End/Data Centre, Transport Network infrastructure/backbone, Hub, Access Network and the subscriber's premises.

The Head-End provides the operational side of TV operator and may include several Game Servers 12, which are operable to output data continuously within the in-band forward path of a DTC via a satellite link to a subscribers Games Console, PC or STB. Alternatively the Games Server 12 may be configured output data continuously within out-of-band FDC over ATM/OC-3 network to a subscribers Games Console, PC or STB. This is achieved through interfacing the Game Servers 12 with the Head-End network through a PCI System that may be Ethernet, IP or DSL.

The Game Servers 12 may also include an Application Specific Integration (ASI) interface that enables the Game Server 12 to be interfaced with the Transport Network or Head-End. The ASI provides access to several different mechanisms and protocols for delivering data between the Game Server 12 and the Subscribers device regardless of whether a Games Console 82, PC 88 or STB 79. In this way the Game Servers 12 are operable to be directly interfaced with a QAM/QPSK Modulator 68.

Of course there is no reason why the Game Server 12 could not be located in the Hub as illustrated in Patent GB 0203790.1. However as the Games System is designed to transport data through the use of in-band DTC satellite signals to a subscribers device and as such from an operational perceptive it is more cost advantageous to centrally situate the Game Servers 12 within the Head-End as illustrated in figure 4.

Referring to figure 4, the Head-End consists of a Games Servers 12 that are connected to an MPEG Encoder 56 which in turn is connected to a Multiplexer 66. In this way data transmitted by the Game Server 12 may be encoded into MPEG-2 transport streams and transmitted within a in-band QAM digital transmission channel (DTC) or out-of-band QPSK forward data channel (FDC) to a users Games Console 82, PC 88 or STB 79.

The MPEG-2 Real-time Encoders (RTE) 56 are operable to compress video and data feeds into MPEG-2 transport streams which are then Multiplexed into a single signal by a Multiplexer 66. The multiplexed signal is than modulated by the QAM/QPSK Modulator 68 into a QAM or QPSK Signal and transmitted via satellite link or transport network to a subscriber's device. It will be appreciated that the process of encoding data within an MPEG-2 transport stream may be achieved in real time.

Also connected to the MPEG Encoder 56 by OC-3/OC-12 cable is the Advert insertion server 58, which provides QAM video content over in-band digital transmission channels (DTC) provided by Direct Broadcast Satellite to subscribers Receiver Dishes. This may be interconnected with the Game Servers 12 for provisioning TV adverts within Graphical User Interface (GUI) provided by the Game System.

Connected to the Multiplexer 66 is Common QAM Content 57 storage from which TV program content may be retrieved and provided over an in-band DTC or analogue transmission channel (ATC) via a DBS satellite transmission to subscribers Receiver Dishes.

Connected to the Multiplexer 66 is a Quadrature Amplitude Modulator (QAM) 68, which provides the in-band forward path for digital transmission channels (DTCs). A DTC is a QAM waveform with a bandwidth of 6 MHz used for transporting MPEG-2 Transport Streams to a Ground Satellite uplink transmitter 67 which using a satellite dish antenna, pointed towards a Geostationary orbit satellite 84 (GEO), is operable to transmit digitised signals to the satellite transponders.

Once received by one of the transponders the signal is then amplified and switched to another frequency to be transmitted back to earth. Those skilled in the art will realise that it is necessary to switch frequencies to prevent interference with the incoming signal. Each satellite typically has 12 to 24 transponders set at different frequencies. A Geo satellite typically uses bandwidths of 11 to 12 GHz (uplink) and 14 GHz (downlink) referred to as the Ku-band.

The signal is then transmitted within the downlink to all subscribers' receivers within the Satellites spot beam, sometimes refereed to as a Wide Swath.

The downlink signal may be received by an 18-inch DBS Satellite Dish 81, which is then feed directly into the Set top box that contains a MPEG decoder and an access card for the decoder. From the Satellite Dish 81 the signal is then converted to a lower frequency and transported to the MPEG decoder.

The MPEG decoder then applies demodulation and the forward error correction code is removed. The signal is then demultiplexed to enable additional data to be extracted. The compressed data stream is the sent to a buffer from where the compression engine could access it.

The downlink may be DVB-S broadcast-based. Data may be provided over a Ka-Band, Ku-Band or C-Band signal from a GEO Satellite to a subscriber's Games Console, STB or PC via an 18-inch Satellite receiver dish.

DBS transmissions are delivered at the 11-to-15 GHz frequency range, known as the Ku-band, at a power that may exceed 120 watts. The higher power of the Ku-band allows a more directed satellite-to-receiver signal and, thus, requires a much smaller receiver dish than is required for C-band reception.

Ku-Band is a frequency range used for a satellite uplink and downlink of a host of signals. The advantage of using Ku-Band is that it requires a smaller dish than C-Band for reception, and is more resilient to interference. Ku Band Satellites typically operates in the 11 to 14 GHz range, these are medium-power satellites, requiring about 40 to 80 watts per transponder and permitting receiving dishes as small 1 meter across.

It will be appreciated that as the data is provided continuously over a digital transmission channel may be received by all subscribers Games Consoles, PCs or STBs with DVB-S receiver within the Satellite beam which would all be operable to

retrieve data packets from the broadcast data stream simultaneously. Thereby reducing the infrastructure cost associated with providing games on demand over broadband.

The Games System service may be provided on a GEO Satellite in multiple beams. It will be appreciated that the transponder parameters, frequency and type of polarisation will be predefined and will depend on the volume of data.

In the case of asymmetric access to the Games System based on the DVB technology, the user may receive up to 40 Mbps and transmit up to 5 Mbps within the RDC. The receiver protocol is DVB-S. The transport protocols for data transfer are TCP/IP, UDP/IP, FTP, VoIP.

For the DVB-based asymmetric access to the Games System, the transmitting teleports use special-purpose equipment, and the receiving earth stations should be equipped with a satellite router as a stand-alone unit or a DVB-S receive card integrated with the user's STB 79, Games Console 82 or PC 88. The antenna diameter and the power of the upconverter depend on the link budget based on the required data rate, modem operation modes and satellite parameters.

It will be appreciated that other Satellite systems including DDS based on C-Band satellite technology may be utilised by the Games Server 12 to provide Games to a subscribers Games Console 82, STB 79 or PC 88.

C-Band refers to a frequency range used for satellite uplink/downlink of a host of signals ranging from radio and television programming to high-speed data services. The band typically exists between 4 and 8 GHz. The 3.7 to 4.2 GHz satellite communication band is used as the downlink frequencies and the 5.925 to 6,425 GHz band that serves as the uplink frequencies.

Alternatively data maybe transmitted within a digital transmission channel DTC in the in-band Forward Path via a Ka-band Satellite transmission to a Satellite receiver dish. Data carried over transmission channel in the in-band Forward Path on a Satellite TV network is received over the air as a satellite transmission by a digital Satellite receiver dish 81, which is connected to the via a downlead to a STB 79.

Ka-band refers to a frequency range used for satellite uplink/downlink of a host of signals. The Ka Band frequency ranges from 18 to 31 GHz. K/Ka-band Gigabit Satellites may be utilised by the Games Server 12 to provide data throughput of (1.2 - 1.5 Gbps), very high data rate (155 Mbps) and multi-player network games (1.5 - 155 Mbps) users. The gigabit links use SS/TDMA while the others use SCPC/TDM uplinks and TDM/TDMA downlinks with onboard ATM switching.

It will be appreciated that various modulations including BPSK, QPSK and 8 PSK with or without direct sequence spreading may be utilised by the Games Server 12 to provide data to subscribers STB 79, Games Console 82 or PC 88 equipped with a DVB-S receiver at a bit rates up to 140Mbps. This is advantageous.

Referring to figure 4, connected to the ATM Switch 65 within the Head-End by a Ethernet 10/100Base-T interface is a series of operation support servers consisting of a Time Of Day (TOD) Server 64, a TPFP Server 62, a DHCP/DNS Server 60 and a Billing Server 59. Also connected by an Ethernet interface to the ATM Switch 65 is a Command Server 61, Middleware Server 63 and the Games Server 12. In this way the Command Server 61, Middleware Server 63 or Games Server 12 may receive requests transmitted within the RDC by the subscriber's Games Console 82 or STB 79.

The Middleware Server 63, is operable to provide HTML, JavaScript and pJava objects to the subscribers STB 79, Games Console 82 or PC 88 that may be used to render a graphical user interface (GUI).

It is also possible through HTML and JavaScript objects to command functionality on the device. For example through HTML objects it is possible to command the STB 79 TV functionality such as switching the Satellite receiver to a specific frequency to receive incoming data over an in-band DTC MPEG-2 transport stream. As previously described a Middleware engine and HTML Browser resident within the Games Console 82, PC 88 and STB 79 enables HTML/JavaScript objects to be interpreted by the subscriber's device.

Connected to the Middleware Server 63 is a Command Server 95, which is operable to control data streams from the Game Servers 12. Monitoring software and diagnostics software provided on the Command Server 61 enables the TV operator to analysis bandwidth usage and identify problems such as bottlenecks within the network.

Also connected via a 10/100Base-t Ethernet network is a Billing Server 59, which is operable to provide transaction authentication and SSL. Connected to the Billing Server 59 is a Trivial File Transfer Protocol (TFTP) Server 62 which provides modem configuration files that may be used by the Games Console 82, PC 88 or Set Top Box (STB) 79 equipped with Satellite Modems/receiver to access the Games System.

A Dynamic Host Configuration Protocol (DHCP) Server 60 provides dynamic assigned IP addresses to the subscribers Games Console 82, PC 88 or STB 79. The DHCP Server 60 also allows the re-use of assigned IP addresses.

A Domain Name System (DNS) Server 60 provides IP addresses to devices connected to the Games System such as the Game Servers 12 or Command Server 38. The DNS Server 60 may also be configured to provide addresses to subscribers and external network devices connected to Internet, enabling subscribers to access content external to the TV network using TCP/IP.

A Time Of Day (TOD) Server 64 provides the synchronisation of native and resident applications on a subscribers device. For example the TOD Server 64 may be utilised to synchronise a program guide with the actual time.

The Middleware Server 63, Command Server 61, Billing Server 59, DHCP Server 60, TFTP Server 62 and TOD Server 64 are all connected via an 10/100Base-t Ethernet network to an Asymmetric Transfer Mode Switch (ATM) 65 that connects the Head-End to the Transport Network infrastructure via Optical cables.

Operation Support System (OSS) software within the Head-End provides Conditional Access (CAM). The hardware upon which the conditional access may be executed may be a Sun Solaris or Windows NT based workstation that may also be the Billing Server 59.

A QAM Modulator 68 provides the in-band Analogue transmission channels (ATCs). An ATC is an AM-VSB waveform and has a bandwidth of 6 MHz used for transporting an NTSC or PAL signals from the Head-End to a subscribers STB 79, Games Console 82 or PC 88.

A QAM Modulator 68 provides the in-band forward path for digital transmission channels (DTCs). A DTC is a QAM waveform with a bandwidth of 6 MHz used for transporting MPEG-2 Transport Streams from the Head-End to a subscribers STB 79, Games Console 82 or PC 88.

Connected to the QAM modulator 68 is a Asymmetric Transfer Mode Switch (ATM) 65 that connects the Head-End to the Transport Network infrastructure that provides the forward and reverse communication paths.

Referring to figure 4, the Transport Network infrastructure/backbone consists of numerous Asymmetric Transfer Mode (ATM) Switches interconnected over optical cables such as Optical Carrier Level 12 (OC-12) to 48 (OC-48). The Transport Network infrastructure is operable to support the transmission of data, video and audio over optical cables within out-of-band QPSK Forward Data Channel (FDC) over as Optical Carrier Level 12 to 48 cables to the Hub. QSPK Modems 74 situated at the Hub are operable to transmit the signal over the Access Network via a Pots splitter shelf 73 to a subscriber's STB 79, Games Console 82 or PC 88.

Referring to figure 4, within the Transport Network optical cables interconnects the ATM switch 65 with a second ATM Switch 71 that connects to the Hub. The Hub consists of Quadrature Phase Shift Keying (QPSK) Modulators 74 that provide the Forward Data Channel (FDC) used for transmitting packets containing IP or MPEG-2 private sections to a users Games Console 82, PC 88 or STB 79.

The FDC is a QPSK waveform with a bandwidth of 1 MHz which may be used for transporting data and various subsystem components from the Hub to a subscribers Games Console 82, STB 79 or PC 88 over Asymmetric Digital Subscriber Lines (ADSL).

Plain Old Telephone System (POTS) Splitter Shelves 73 interconnect the Hub with the Access Network, which in turn interconnect the subscribers Games Console 82, PC 88 or STB 79 via ADSL cable to the QPSK Modulators 74 within the Hub.

The Access Network often referred to, as the last five miles or the local loop, connects the Hub to the subscribers STB 79, PC 88 or Games Console 82. For Satellite TV subscribers this is typically with ADSL/POTS via a dial up modem to subscribers device as illustrated by figure 4.

Referring to figure 4, the home subscribers premises includes a 18-inch satellite dish 81 for receiving video, audio and data from a satellite link, which is connected to a STB 79 which may used to play games. The subscribers STB 79 includes a standard DVB-S Satellite Receiver Dish 81 operable to receive C, L, X and KU - Band signals which is connected to a Satellite Modem via a BNC connection. This modem may be a DVB-S based.

Figure 4 also shows a Games Console 82 within the subscribers premises which is also connected to the 18-inch satellite dish 85 via coax cable, which connects to a Satellite receiver/modem contained within the Games Console 82. The a Satellite receiver/modem enables data to be received by the Games Console 82 from a Ka-band or Ku-Band satellite signal which may be provided at bit rate of up to 45 Mbps. The Satellite receiver/modem is also operable to transmit and receive data from out-of-band QPSK signals via the dial-up connection 83.

Included within each Games Console 82, PC 88 or STB 79 is a resident or native application that is operable to retrieve data received from a QPSK/BPSK out-of-band or in-band satellite signals using the satellite receiver/modem. The application is also operable to buffer data received over an out-of-band or in-band signal into the device memory from which a game may be rendered.

Connected to the Games Console 82 via dial up connection 83 is the Access Network, which contains a series or routers and switches on which data may be transmitted to and from the Hub. Within the Hub a series of QPSK modems 74 provide the out-of-band QPSK Forward data channel (FDC) to a users Games Console 82, PC 88 or STB 79. In this way data packets received over the transport network from a Game Server 12 may be transmitted over the Access network to a users Games Console 82, PC 88 or STB 79 provided within a 1 to 6 MHz QPSK waveform.

The QPSK modems 74 within the Hub are also operable to convert data received from out-of-band QPSK signals transmitted within the Reverse Data Channel (RDC) from a subscribers Satellite modem within a Games Console 82, PC 88 or STB 79.

The QPSK modems 74 in the Hub are also operable to transmit signals received from the subscribers Games Console 82, PC 88 or STB 79 to the Command Server 61 located in the Head-End of a Satellite content provider. Connected to the QPSK modems 74 is an ATM switch 71, which in turn is connected to a series of ATM

switches which connect the Hub via the Transport network with a second ATM switch 65 located in the Regional Head-End.

Also connected to the ATM Switch 71 on the Transport Network is a Proxy Servers 72 and Transcoder Servers 70. The Proxy Servers 72 provide HTTP links between the Satellite TV network and external networks such as the Internet. The Proxy Server 72 is operable to provide software objects to a subscriber's STB 79, Games Console 82 or PC 88. These objects may be HTML documents, Java applets or XML documents.

The Proxy Server 72 may also provide filtering of requests, translation, and client authentication. A Proxy Server 72 typically uses an IP Gateway to distribute objects to a subscriber's STB 79, Games Console 82 or PC 88. These objects may be HTML or JavaScript objects or other applications.

The Transcoder Servers 70 provides the communication link between the Game Server 12 and subscribers device whether an STB 79, Games Console 82 or PC 88. The Transcoder Server is operable to convert RDC signals received from a DVB Satellite Modem in to IP data packets, which may then transmitted over the Transport Network to a Game Server 12, Middleware Server 63 or Proxy Server 72.

Referring to figure 4, the subscriber's premises includes a STB 79, PC 88 and a Games Console 82 that are connected to the Hub via a dial up modem and Satellite receiver. The Satellite modem provides QPSK modulation and demodulation.

Referring to figure 4, the Games Console 82 consists of 120MB RAM, a 480MHz central processor unit (CPU), 32MB DRAM Memory, Digital Video Disc (DVD) Drive, a 3D Graphics Accelerator chip, Universal Serial Bus (USB) ports, a FireWire port, a 16MB Memory Card, an MPEG-2 decoder, and an Operating System (O/S).

The CPU is operable to interpret and execute instructions. The CPU is used to fetch, decode and to transfer data to and from resources. Data transferred between the Games Consoles 82 resources is transferred over the main data transfer path, the bus, which enables the CPU to command the Games Consoles 82 resources.

Random Access Memory (RAM) often referred to as the volatile memory is a semiconductor based memory that can be read and written by the CPU or other hardware devices. The CPU typically utilises the RAM when rendering a Game.

Dynamic RAM (DRAM) is a type of semiconductor random access memory which may be utilised by the CPU to store and retrieve data. DRAM is typically used during a game acting as a memory buffer with the RAM. Memory buffers hold data temporarily for processing allowing the CPU to access the data at a faster rate than on a DVD or hard disc. DRAM has the advantage of being able to store more data than RAM.

The memory card is a memory module containing random access memory (RAM) semiconductor chips that may be utilised by the CPU to store data or programs. The module may also comprise of EPROM, RAM, ROM or flash memory chips.

Digital Video Disc (DVD) drive is traditionally used by the Games Console 82 to access data, video and audio which has been encoded on a compact disc (CD). A DVD can store greater amounts of data than a traditional CD ranging from 4.7 GB to 17 GB.

The Graphics Card 17 contains a coprocessor, which is a specialised microprocessor that can update graphics on a screen far quicker than a CPU can. The coprocessor is vital to performance of a Games Console 82 as it able to free up the CPU for other tasks. All present Games Consoles contain a Graphics coprocessor of some kind, which can generate polygons, texture maps, filters and lines in response to instructions from the CPU.

The FireWire (i-Link) port allows external devices to be connected to the Games console 82 such as a Hub, which enables multiple players to play against each other. The FireWire (i-Link) port will support data rates of up to 400 Mbps.

The MPEG decoder is operable to decode MPEG-2 streams received from a Satellite TV signal. In this way video, audio and data compressed and digitised into an MPEG-2 transport stream and transmitted within an in-band DTC or out-of-band FDC signal can be decoded and interpreted by the CPU. It will be appreciated that the MPEG decoder may of course be software based or may form part of a Satellite TV receiver.

The Universal Serial Bus (USB) ports enables external devices including Games Pads, Joysticks, Steering Wheels, Keyboards, Mousses, Modems and Network adapters to be connected to the Games Console 82.

The Games Console 82 may also include an optional Hard Disc or Optical Disc Drive on which games retrieved from a DTC or FDC may be stored. The Games console 82 is typically connected to users TV screen 86 via an AV lead to a TV Scart port or via S-video cable.

Referring to figure 4, the STB 79 is also connected to a dial up connection 78. The dial up connection is utilised by the Satellite modem or V.90 Analogue modem to transmit data over the Access Network to QPSK modems 74 situated at the Hub.

In figure 4, the Satellite modem/receiver is illustrated internal to a Games Console 82, however this may be external to the device through various different interfaces including a USB, Firewire or Ethernet adapter.

Those skilled in the art will realise that the term modem is derivative to that of the term's modulation and demodulation. However the modems described herein are high-speed Satellite modems designed for high bandwidth data and video transmissions at bit rates

of 4 to 45 Mbps and not 28.8 Kbps analogue modems which most will be familiar with in terms of the Internet.

The Satellite modem/receiver is operable to demodulator and modulate signals to and from QPSK modems located within the Hub. The Satellite modem/receiver is also operable to retrieve data, video and audio transmitted within a Ku-band, Ka-band or C-band satellite transmission by QAM Modulator located within the Headend.

The Satellite modem/receiver may be connected to a Games Console via a type III PCMCIA Card slot within the expansion bay. It will be appreciated that various different Interfaces may be used to interface the Satellite Modem/receiver 16 including Ethernet 10Base-T, RJ-45 connectors, USB Series B connector, Cable RF Input, 75 Ohm F-Connector. Alternatively a 10/100 Base TX Ethernet card may be used to connect the Games Console 15 to the TV network and in turn the Games Server 12.

A QPSK demodulator within the users Satellite modem/receiver is operable to receive IP packets and MPEG-2 private data sections. Using a QPSK demodulator the Satellite modem/receiver is operable to receive data transmitted within a forward data channel (FDC) signal from the Games Server 12. A FDC is a QPSK waveform with a bandwidth of 1 MHz used for transmitting data to a subscriber's device from the Hub 45. Satellite modem/receiver typically utilises one FDC for receiving both application data and instructions at any given time.

A QPSK modulator within the subscriber's Satellite modem/receiver provides an out-of-band Reverse Data Channel (RDC). The RDC is also a QPSK waveform with a bandwidth of 1 MHz used for transmitting data from a subscriber's device to the QPSK modems 74 in the Hub.

A Satellite modem/receiver typically utilises one RDC for sending both application data and control messages at any given time. Those skilled in the art will realise that the QPSK modems 74 in the Hub may be configured to provide multiple RDC's to one Satellite modem/receiver at any given time for providing data inputs and requests from the Games Console 82 to a Game Server 12.

A QAM demodulator within the subscribers Games Console 82 is operable to adapt to channels encoded at different rates of up to 56 Mbps. Thereby enabling data to be received at up to 56 Mbps. In this way data may be retrieved from a QAM in-band DTC signal at a bit rate of 45 Mbps which may be buffered into a Games Consoles 82 memory and rendered through utilising the Random Access Memory (RAM) 11. This is advantageous.

The Games Console 82 and Satellite modem/receiver supports the key functions of, audio and video transport stream demultiplexing for Satellite broadcasts, source decoding, video encoding/transcoding, streaming audio and video, still imaging, return channel communications, home networking and storage. Software applications resident on the Games Console 82 facilitate the means of accessing game data over a

DTC or FDC from the Satellite TV network. The software drivers resident within the Operating System provide the means enabling the Games Console 82 to utilise existing communication paths and infrastructure of a Satellite TV network to transmit data upstream to the Games Server 12.

Connected to the Games Console 82 is a Satellite Receiver Dish 85 which is operable to receive C, L, X, K/Ka and Ku-band signals transmitted by a DBS Satellite 84. The Satellite Receiver Dish 85 is connected to a Satellite Modem/receiver via a BNC connection. This modem may be a DVB-S based. In this way games provided by the Games Server 12 within a Ka-band or Ku-band Satellite signal may be received by subscribers Games Console 82. This is advantageous.

It will be appreciated that various modulations including BPSK, QPSK and 8 PSK with or without direct sequence spreading may be utilised by the Games Server 12 to provide data to subscribers Games Console 82 with a DVB-S Satellite Modem/receiver at a bit rates up to 140Mbps. This is advantageous.

Through Ka-band based Satellites the reverse data channel (RDC) may be provided without the use of dial up interface. Those skilled in the art will realise that a Satellite Modem/receiver can transmit at data rates of up to 2Mbits/sec in a Ka-Band (29.5-30GHz) and has a receive capability of 38Mbits/sec (DVB MPEG-2).

The return path over a satellite link maximum bit rate is however dependent on the size of the subscriber's dish. For example 144Kbits/sec may be achieved with a 65-75cm dish, 384 Kbits/sec with a 79-95cm dish and 2.048Mbits/sec with 95-120cm dish. This is advantageous.

Connected by a s-video or AV lead to the subscribers Games Console 82 is a TV screen 86 that is operable to display video decoded by an MPEG decoder in the Games console and graphics rendered within the RAM. Alternatively the Games Console 15 may be connected via a S-VHS lead. The TV screen 86 includes speakers from which audio may be output.

Referring to figure 4, the Set Top Box (STB) 79 consists of an 80MHz Central Processor Unit, 4MB RAM, 2MB Flash Memory, 4MB DRAM, 256 KB EEPROM, 2 Smart card interfaces, 2 USB ports, a Graphics Processor Unit with 4MB SDRAM, an infra-red port, a built-in Modem, an MPEG decoder, an RF Tuner and software.

The CPU is a microprocessor which operable to interpret and execute instructions. The CPU is used to fetch, decode and to transfer data to and from the STB 79 resources. Data is transferred over the STB's 79 main data transfer path, the bus, which enables the CPU to command the STB's 79 resources.

Random Access Memory (RAM) often referred to as the volatile memory is a semiconductor based memory that can be read and written by the CPU or other hardware devices. The CPU typically utilises the RAM when rendering a Game.

Flash Memory is a type of non-volatile memory is built into the STB 79. Flash memory is similar to EEPROM memory in function however data must be removed in blocks. The CPU utilises the flash memory to store data. In this way the Flash Memory acts as a replacement to a hard disc.

Dynamic RAM (DRAM) is a type of semiconductor random access memory which may be utilised by the CPU to store and retrieve data. The CPU utilises the DRAM as a memory buffer for game data. Memory buffers hold data temporarily for processing allowing the CPU to access the data at a faster rate than on a Flash Memory. DRAM has the advantage of being able to store more data than RAM.

Electrically Erasable Programmable read-only Memory (EEPROM) is a type of Erasable Programmable read-only Memory that can be erased with an electrical signal. EEPROM is typically used to store data for long periods without electricity while still allowing reprogramming. EEPROM has less memory than RAM and can only be reprogrammed a limited number of times before wearing out.

The Graphics Processor Unit (GPU) is a coprocessor, which is a specialised microprocessor that can update graphics on a screen far quicker than a CPU can. The coprocessor is vital to performance of a STB 79 as it able to free up the CPU for other tasks. The majority of present Set top boxes contain a Graphics coprocessor of some kind, which can generate polygons, texture maps, filters and lines in response to instructions from the CPU.

The MPEG decoder is operable to decode MPEG-2 streams received from a Satellite TV signal. In this way video, audio and data compressed and digitised into an MPEG-2 transport stream and transmitted within an in-band DTC or out-of-band FDC signal can be decoded and interpreted by the CPU. It will be appreciated that the MPEG decoder may of course be software based or may form part of a Satellite TV receiver.

The remote control and Infrared interface are standard in all current Set top boxes and are used to relay user commands to the Set top box 79. In this way the user is able to control a game through the manipulation of the buttons on the remote control.

Referring to figure 4, the STB 79 is also connected to a dial up connection 78. The dial up connection is utilised by the modem to transmit data over the Access Network to QPSK modems 74 situated at the Hub.

The Satellite Modem/receiver built in to the STB 79 enables QPSK Waveforms to be received and transmitted. Data may be transmitted through the QPSK modulator which enables the STB to utilise the Reverse Data Channel (RDC) with a QPSK waveform, which in turn provides a return path whereby requests and data inputs maybe transmitted upstream to a Game Server 12, Middleware Server 63 or Proxy Server 72. A QPSK demodulator enables the STB 79 to retrieve data within the out-of-band

Forward Data Channel (FDC) provided by the Game Server 12, Middleware Server 63 or Proxy Server 72.

Those skilled in the art will realise that a QPSK Modulator 74 typically located in the Hub is operable to transmit packets containing IP or MPEG private sections over the FDC to the users STB 79. QPSK demodulators 74 present within the hub enable data to be retrieved from the RDC and transported over the transport network to a Games Server 12, Middleware Server 63 or Proxy Server 72.

A QAM demodulator within the STB 79 enables data to be retrieved from within QAM signal provided by the Game Server 12, Middleware Server 35 or Proxy Server 40. QAM signals are QAM waveforms which provides a forward path whereby data, audio and video maybe broadcast via a Satellite transmission to all subscribers devices by a Game Server 12, Middleware Server 63 or Proxy Server 72 within a digital transmission channel (DTC).

It will be appreciated that various different protocol specifications may be used including DVB-S (Digital Video Broadcasting Satellite), DVB-RCS (Return Channel For Satellite), IEEE 802.14, to facilitate the transmission of data within the FDC or RDC.

The STB 79 and Satellite Modem/receiver supports the key functions of, audio and video transport stream demultiplexing for Satellite broadcasts, source decoding, video encoding/transcoding, streaming audio and video, still imaging, return channel communications, home networking and storage. Software applications provided on the STB 79 facilitate the means of accessing game data over a DTC or FDC from the Satellite TV transmission. The software also provides the means enabling the STB to utilise existing communication paths and infrastructure of a Satellite TV network to transmit data upstream to the Games Server 12.

Connected to the Set top box (STB) 79 is a Satellite Receiver Dish 81 which is operable to receive C, L, X, K/Ka and Ku-band signals transmitted by a DBS Satellite 84. The Satellite Receiver Dish 81 is connected to a Satellite Modem/receiver via a BNC connection. This modem may be a DVB-S based. In this way the subscribers STB 79 may receive games provided by the Games Server 12 within a Ka, C, L or Ku-band satellite transmission signals. This is advantageous.

It will be appreciated that various modulations including BPSK, QPSK and 8 PSK with or without direct sequence spreading may be utilised by the Games Server 12 to provide data to subscribers STB 79 with a DVB-S Satellite Modem/receiver at a bit rates up to 140Mbps. This is advantageous.

Through Ka-band based Satellites the reverse data channel (RDC) may be provided without the use of dial up interface. Those skilled in the art will realise that a Satellite Modem/receiver can transmit at data rates of up to 2Mbits/sec in a Ka-Band (29.5-30GHz) and has a receive capability of 38Mbits/sec (DVB MPEG-2).

The return path over a satellite link maximum bit rate is however dependent on the size of the subscriber's dish. For example 144Kbits/sec may be achieved with a 65-75cm dish, 384 Kbits/sec with a 79-95cm dish and 2.048Mbits/sec with 95-120cm dish. This is advantageous.

Connected Set Top Box (STB) 79 via a Scart lead is a TV screen 80 which is operable to display video decoded by a MPEG decoder in the STB 79 and graphics rendered by Graphic Processor Unit (GPU).

Referring to figure 4, the diagram shows a third subscriber that is connected to the access network via a dial up connection 87 which in turn is connected to a Personnel Computer PC 88.

The Personnel Computer (PC) 88 contains a 1.2 GHz Central Processor Unit, 120MB RAM, 24MB DRAM, 32MB SDRAM, 512KB EEPROM, DVD Drive, 128MB 3D Graphics Accelerator chip, a 40 Gigabyte Hard Disc, an PS2 port, a Modem/receiver, a MPEG-2 decoder and an Operating System (O/S).

The CPU is a silicon based microprocessor which operable to interpret and execute instructions. The CPU is used to fetch, decode and to transfer data to and from resources. Data is transferred over the PC's 88 main data transfer path, the bus, which enables the CPU to command the PC's 88 resources.

Random Access Memory (RAM) often referred to as the volatile memory is a semiconductor based memory that can be read and written by the CPU or other hardware devices. The CPU typically utilises the RAM when rendering a Game.

Dynamic RAM (DRAM) is a type of semiconductor random access memory which may be utilised by the CPU to store and retrieve data. The CPU utilises the DRAM as a memory buffer for game data. Memory buffers hold data temporarily for processing allowing the CPU to access the data at a faster rate than on a DVD or hard disc. DRAM has the advantage of being able to store more data than RAM.

Electrically Erasable Programmable read-only Memory (EEPROM) is a type of Erasable Programmable read-only Memory that can be erased with an electrical signal. EEPROM is typically used to store data for long periods without electricity while still allowing reprogramming. EEPROM has less memory than RAM and can only be reprogrammed a limited number of times before wearing out.

Digital Video Disc (DVD) drive is traditionally used by the PC 88 to access data, video and audio which has been encoded on a compact disc (CD). A DVD can store greater amounts of data than a traditional CD ranging from 4.7 GB to 17 GB.

The Graphics Card contains a coprocessor, which is a specialised microprocessor that can update graphics on a screen far quicker than a CPU can. The coprocessor is vital to performance of a PC 88 as it able to free up the CPU for other tasks. The majority of

present PCs contain a Graphics coprocessor of some kind, which can generate polygons, texture maps, filters and lines in response to instructions from the CPU.

The MPEG decoder is operable to decode MPEG-2 streams received from a Satellite TV signal. In this way video, audio and data compressed and digitised into an MPEG-2 transport stream and transmitted within an in-band DTC or out-of-band FDC signal can be decoded and interpreted by the PC 88. The MPEG decoder may be connected to the PC 88 via a PCI slot. It will be appreciated that the MPEG decoder may of course be software based or may form part of a Satellite Modem/receiver.

The PS2 interface is standard on all PCs and enables the user to command a game using a keyboard or mouse. In this way the user is able to control a game through manipulating the buttons on the keyboard or mouse, which may be interpreted by a game engine on the PC 88 and the corresponding graphics to users inputs are rendered on the screen. With present PC systems this process can be performed in real time.

According to the present invention subscribers of Satellite TV may be provided with USB adapter. The USB would enable a PC 88 to be indirectly interfaced via a USB interface to a DVB-S Satellite modem that is operable to connect to the Game Server 12.

According to yet a further aspect of the present invention a PC 88 may be directly interfaced to the Game Server 12 situated with the Head-End via a Satellite Modem/receiver or a dial up modem. The Satellite Modem/receiver may be connected to a PC 88 via an expansion bay. Alternatively an Ethernet Network Card 10/100Base-t may be used to connect the PC 88 to the Games Server 12.

In this way a PC 88 may access data within the in-band and out-band signals provided by the Games Server 12. In addition through the Satellite Modem or a dial up modem the PC 88 may transmit requests or data via the reverse data channel (RDC) upstream to the Game Server 12 with the Head-End. This is advantageous.

Connected to the PC 88 is a Satellite Receiver Dish 89 which is operable to receive C, L, X, K/Ka and Ku-band signals transmitted by a DBS Satellite 84. The Satellite Receiver Dish 89 is connected to a Satellite Modem/receiver via a BNC connection. This modem/receiver may be a DVB-S based. In this way the subscribers PC 88 may receive games provided by the Games Server 12 within a Ka, C, L or Ku-band satellite transmission signals. This is advantageous.

It will be appreciated that various modulations including BPSK, QPSK and 8PSK with or without direct sequence spreading may be utilised by the Games Server 12 to provide data to subscribers PC 88 with a DVB-S Satellite Modem/receiver at a bit rates up to 140Mbps. This is advantageous.

Through Ka-band based Satellites the reverse data channel (RDC) may be provided without the use of dial up interface. Those skilled in the art will realise that a Satellite Modem/receiver can transmit at data rates of up to 2Mbits/sec in a Ka-Band (29.5-30GHz) and has a receive capability of 38Mbits/sec (DVB MPEG-2).

The return path over a satellite link maximum bit rate is however dependent on the size of the subscriber's dish. For example 144Kbits/sec may be achieved with a 65-75cm dish, 384 Kbits/sec with a 79-95cm dish and 2.048Mbits/sec with 95-120cm dish. This is advantageous.

The PC 88 and Satellite Modem/receiver supports the key functions of, audio and video transport stream demultiplexing for Satellite broadcasts, source decoding, video encoding/transcoding, streaming audio and video, still imaging, return channel communications, home networking and storage.

Software applications provided on the PC 88 facilitate the means of accessing game data over a DTC or FDC from a Satellite transmission or over Satellite TV network. The software also provides the means enabling the PC 88 to utilise existing communication paths and infrastructure of a TV network to transmit data upstream to the Games Server 12.

According to the present invention means may be provided whereby a subscriber may trigger a game to download directly relating to video preview of a game provided on a digital transmission channel (DTC) or an analogue transmission channel (ATC) using a Games Console 82, PC 88 or STB 79.

For example, referring to figure 4, a subscriber may be watching a video preview of a game provided on a DTC by the Games Server 12 or QAM Content Servers 29 in which HTML/JavaScript or C++ objects containing triggers are transmitted to the subscriber's Games Console 15. The CPU in the Games Console 82 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image which is displayed in the top right corner of the TV screen prompting the subscriber to download a game.

Through manipulating the buttons on the Games Pad the subscriber may respond to the prompt. If the subscriber responds by pressing the select button on Games Pad then a signal is then transmitted to the CPU in the Games Console 82. Through software provided on the Games Console 82 the CPU interprets the data input signal and instructs the Satellite Modem/receiver connected via PCMCIA slot to switch channels to correct MPEG packet ID (PID) required for the game. The Satellite modem then performs a handshake with the MTS situated at the Head-End. This is needed to agree on how to transmit/receive game data and is based on a protocol that defines the type of signalling, frequencies used and authentication.

The game data, which is being transmitted continuously by the Games Server 12 within a DTC, is then received via the Satellite Receiver Dish 89 and demodulated by the

Satellite Modem/receiver. An MPEG Decoder in the Games Console 82 is then operable to decompress and decode the digitised data stream provided within an MPEG-2 transport stream.

The CPU then buffers the data onto the Games Console 82 Dynamic Random Access Memory (DRAM) and the game is rendered using the RAM. The rendered graphics are then output from the Games Console 82 via an AV-video lead which is connected to a TV Screen 86 upon which the game is displayed. Through manipulating the buttons on the Games Pad the subscriber is operable to control the game. This is advantageous.

Referring to figure 4, according to yet a further aspect of the present invention subscribers may be provided with a user interface from which the subscriber may select and download games to a STB 79, Games Console 82 or PC 88. This is achieved through transmitting HTML/Java data in the DTC, in-band Forward Path, or an out-of-band forward data channel (FDC) to a subscribers STB 79, Games Console 82 or PC 88.

For example a subscriber may be watching a video preview of a game provided on a DTC by the Games Server 12 or QAM Content Servers 57. Within the data stream of the DTC HTML/JavaScript or C++ objects containing triggers are transmitted via DBS Satellite 84 to the subscriber's Satellite Receiver Dish 89 which is then transported to the Games Console 82. Using the Middleware engine the Games Console 82 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen 86 prompting the subscriber to access the games by pressing select button on the game pad.

If the subscriber responds by pressing the select button on the game pad a signal is then transmitted to the CPU of Games Console 82. Through software provided on the Games Console 82 the CPU is operable to interpret the subscribers data input. The CPU then launches a resident application which is operable retrieve HTML, JavaScript or C++ data from the DTC which is temporally stored in the Dynamic Random Access Memory (DRAM) of the subscriber's Games Console 82.

Using a Middleware engine resident on the Games Console 82 is operable to render the user interface (UI) using the HTML, JavaScript or C++ objects provided by a Games Server 12, Middleware Server 63 or Proxy Server 70. Those skilled in the art will realise that the UI is typically realised within the RAM of the Games Console 82.

Preferably video previews of games available may be provided within the user interface. This is achieved through overlaying HTML, Jpeg and GIF graphics provided within the data stream on MPEG video received within the in-band DTC signal. The video may be defined within HTML parameters of the user interface.

The subscriber is then able to navigate the user interface by manipulating the buttons on the game pad, which is may be interpreted by the CPU and which in turn highlights

the subscriber's selection. The subscriber then presses the select button on games pad, which sends a signal to the CPU in Games Console 82. The CPU is operable to interpret the subscribers data input and instructs the Satellite Modem/receiver to switch to the correct Channel ID, Service ID and Packet Identity (PID) relating to game selected. The Satellite modem/receiver then performs a handshake with the MTS situated at the Head-End. This is needed to agree on how to transmit/receive game data and is based on a protocol that defines the type of signalling, frequencies and authentication used. For example this protocol may be DVB-S based.

Authentication is provided through the conditional access system that provides a link from the subscriber's device back to the service provider Head-End so that a viewing history can be obtained by the Billing Server 59 for billing purposes. The conditional access system enables the subscriber to utilise pay-per-play services provided by the Games Server 12. The conditional access system is typically provided through a multi-step encryption/decryption scheme. The steps could include DES, RSA and digital signature algorithms.

The conditional access system also provides information that restricts the receiving party to only access games content which it is authorised to view or have agreed to pay for. The conditional access system could also be configured for copy control to prevent taping with games, a regional control may be used to blackout specific regions and a user control for parental control of games.

Once the subscriber is authenticated and the receiving protocol is defined data may then received by the Satellite modem/receiver via the Satellite Receiver Dish 89. Satellite Modem/receiver then receives data output by the Games Server 12 via the Satellite Receiver Dish 89 provided within the DTC as MPEG TS. Through an application the Games Console 82 is operable retrieve the data from Satellite modem/receiver 52 which is then buffered in to the DRAM of the Games Console 82 from which the game may be rendered.

Those skilled in the art will realise that a game is typically realised within the RAM of a Games Console 82. In this way the subscriber may visually select a game from a user interface by highlighting a game of their choice using a games pad and download the game on to the Games Console 82 memory from which the game may be played. This is advantageous.

Referring to figure 4, according to yet a further aspect of the present invention game data required by a Games console 82, PC 88 or STB 79 may be stored on the Games server 12 and transmitted continuously or on demand to specific user. This is achieved through interfacing the Game Servers 12 with a QAM Modulator 68, at the Head-End.

For example the Games Server 12 situated within the Head-End may be configured to output game data stored on a hard disc, optical disc, DVD or disk array continuously to as a raw data stream to an Real Time MPEG Encoder (RTE) 56. The RTE 56 is operable to compress and encode the data provided by Games Server 12 into separate

MPEG Transport streams that are the multiplexed and combined into single channel by a Multiplexer 66. The QAM modulator 68 then modulates the channel within 256 QAM waveform. This provides a data throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction.

Once the forward error correction is complete the QAM signal is then transmitted to a Ground Satellite Uplink 67 that is operable to transmit the QAM signal within uplink on a frequency ranging from 17.3 to 17.8 GHz to one of the DBS Satellites transponders 84. The DBS Satellite 84 then translates the uplink signal to a frequency between 12.2 and 12.7 GHz, amplifies it and sends it back to earth within the downlink to all subscribers with Satellite Receivers with DBS satellites 84 spot beam.

For example a subscriber may be watching a video previews of games provided on a separate QAM digital transmission channel (DTC) by the Games Server 12 or QAM Content Servers 57. Within the data stream of the DTC HTML/JavaScript or C++ objects containing triggers are transmitted via Satellite Receiver Dish 89 to the subscriber's Games Console 82. Using the Middleware engine the Games Console 82 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen 86 prompting the subscriber to access the games by pressing select button on the game pad.

If the subscriber responds by pressing the select button on the game pad a signal is then transmitted to the CPU of Games Console 82. Through software provided on the Games Console 82 the CPU is operable to interpret the data input. The CPU then launches a resident application which operable retrieve HTML, JavaScript or C++ data from the DTC which is then temporally stored in the Dynamic Random Access Memory (DRAM) of the subscriber's Games Console 82.

Using a Middleware engine the Games Console 82 is operable to render the user interface (UI) using the HTML, JavaScript or C++ objects provided by a Games Server 12, Middleware Server 63 or Proxy Server 72. Those skilled in the art will realise that the UI is typically realised within the RAM of the Games Console 82.

The subscriber is then able to navigate user interface by manipulating the buttons on the game pad, which is then interpreted by the CPU and the corresponding selection to subscriber's inputs are highlighted on UI which is displayed on the TV Screen 86. The subscriber is then able to select and highlight a game of their choice using the games pad.

The subscriber then selects a game by highlighting a game of their choice and pressing the select button. The CPU then interprets the data input and instructs the DVB-S Satellite modem/receiver to switch to correct channel and transport stream identifiable within the PID, SID and Channel ID. The Satellite modem/receiver 52 then performs a handshake with the MTS 28 situated at the Head-End. This is needed to agree on how

to transmit/receive game data based on a protocol that defines the type of signalling, frequencies used and authentication.

The QAM signal is then received by Satellite Dish 85 which feed to the DVB-S Satellite modem/receiver that is contained with the Games Console 82. The Satellite modem/receiver is operable to demodulator, demultiplex the QAM signal. The data stream is then separated from audio and video signals. The data signal is then transferred to the MPEG decoder that decodes the data back to its original form and the data is then buffered into DRAM of Game Console 82 from which the game may be rendered.

Using the random access memory the CPU then renders the Game which is then output from the Games Console 82 via an audio and video (AV) lead which is connected to a via TV Scart adapter to the TV Screen 86 upon which the rendered games graphics are displayed. Through manipulating the buttons on the Games Pad the subscriber is operable to control the game. This is advantageous.

In this way games which are output by the Games Server 12 to a QAM Modulator 68 maybe transmitted continuously over a Satellite transmission within a DTC from which games maybe downloaded via a user interface onto a Games Console 82, PC 88 or STB 79 at anytime. It will be appreciated that through providing game data over a DTC or ATC the games are being transmitted as a Satellite broadcast, which may be incepted by anyone with a Satellite Receiver Dish that is tuned into the right channel signal.

Those skilled in the art will realise that a channel is a separate incoming QAM signal or ATC source that a subscriber can select through a RF tuner. As such the signal has a defined bandwidth with of 6 to 8MHz that may be utilised to provide games to a subscribers Games Console 82, PC 88 or STB 79 equipped with a DVB-S Satellite Modem/receiver. Typically a channel will exist within a range of 50-850MHz.

It will be appreciated that all DTC or ATC have bandwidth and that the amount of bandwidth required is only proportional to the size of a game and not the number of users. In a traditional Internet system bandwidth is directly proportional to amount of data transmitted and the numbers of users. This is disadvantageous. It will also be appreciated that through transmitting the game data continuously within a DTC as Satellite broadcast only one copy of a game is required to be stored on a Games Server 12. This is advantageous.

According to yet a further aspect of present invention means may be provided whereby up to 20 MPEG-2 transport streams containing game data may be aggregated into one 256-QAM Digital Transmission channel, which may be provided continuously over a Satellite Broadcast File System (BFS). This is achieved through combining multiple MPEG-2 data transport streams in to a signal 256-QAM Waveform that may be broadcast to all viewers with equipped with Satellite Receivers within a DBS Satellites spot beam radius.

It will be appreciated that this may be scaled to suit the TV operator's requirements whereby up 200 MPEG-2 transport streams each containing a different game may be provided continuously over multiple QAM channels. This is advantageous.

Referring to figure 4, according to yet a further aspect of the present invention game data that is stored on the Game Server 12 Storage Subsystem may be transmitted over a variety of links to a subscribers Games Console 82, PC 88 or STB 79. These may include Satellite TV Networks Transmissions, IP, IPv6 or ATM or ADSL.

Those skilled in the art will realise that a data transmission may be provided over a simplex or full duplex (using an interaction channel for the return) and may be Unicast (point-to-point), Multicast (one to many) or broadcast (all receivers receiving the assigned PID).

Referring to figure 4, according to yet a further aspect of the present invention there are five main methods of providing game data within a DTC or FDC to a users Games Console, PC or STB which consist of Data Piping, Data Streaming, Data Carousels or Object Carousels.

Data Piping is a method used by the Games Server 12 to deliver discrete pieces of game data using containers to the destination. Those skilled in the art will realise that typically there is no timing relationship between other (PES) packets and the game data packets.

Data Streaming is a method used by the Game Server 12 to provide game data, which takes the form of a continuous stream that is carried in an asynchronous PES.

Data Carousels is a method that may be used by the Game Server for assembling game data sets into a buffer, which are played-out cyclic manner (periodic transmission). The data sets may be of any format or type i.e. HTML, Java or C++. For example this technique may be used to provide the data for an onscreen On-line Games Guide. The data may be transmitted using fixed sized DSM-CC sections.

A yet further method that may be used by the Game Server 12 to transport data is referred to as an Object Carousel. Object carousels typically resemble data carousels, however they are primarily intended for the broadcast of data services. Those skilled in the art will realise that the data sets are typically defined by the DVB Network Independent Protocol specification and may be used, to down-load data to a Games Console, PC or STB.

Referring to figure 4, the Satellite TV operator network uses a Broadcast File System (BFS) for transporting data repeatedly over the network. This enables the TV operator to provide data such as EPG listings continuously to a STB. Through the present invention the BFS allows Satellite TV subscribers equipped with a Games Console 82, PC 88 or STB 79 to quickly access games at anytime without requiring the use of an

RDC to request data from the Game Server 12. This mechanism is useful where large numbers of subscribers require the same game data. An example would be where the same game is made available to any Games Console that has access to the DTC or FDC. This is advantageous.

It will be appreciated that a number of different transport protocols may be used to transmit data over the Transport network to the STB 79, Games console 82 or PC 88 such as Schedule Transfer (ST), ATM, TCP/IP, RTSP and IPTV. Through utilising transport protocols such as ST this provides an optimal data output suitable to transmit game data over a Satellite TV operators network or a DBS Satellite 84 transmission.

Through continuously outputting data from the Game Server 12 over the BFS a subscriber may access and begin to download a game at any point of the data cast regardless of when the user triggers the download. Any data provided within the BFS that is transmitted via in-band QAM or out-of-band QPSK signals may be accessed through a data stream manager resident on the users STB 79, Games Console 82 or PC 88 which is activated on users request.

The data stream manager is a resident application on the user STB 79, Games Consoles 82 or PC 88 that enables game data to be retrieved and interpreted from the BFS into the device DRAM or Flash memory where it is then rendered on a TV Screen. Those skilled in the art will realise that a game is typically realised in the RAM of a device.

For example referring to figure 4, an application resident on the Games Server 12 is operable retrieve the game data, audio and video that is stored within the Games Server 12 sub storage system. The data, audio and video is then output via an AM Fiber Transport Network or SONET/SDH Transport Network interface to the MPEG Encoder 56. The MPEG Encoder 56 then encoders the data, audio and video into separate elementary streams that are then combined to form individual MPEG Transport Streams. During this process each MPEG TS is assigned a unique PID that is identifiable with a particular game provided within the games systems user interface or channels.

The signal is output from the MPEG Encoder 56 as MPEG TS to a Multiplexer 66 that combines the MPEG TS with other incoming signals using Time Divisional Multiplexing TDM and Frequency Divisional Multiplexing (FDM) techniques. The signal is then output from the Multiplexer 66 to a QAM Modulator 68, which modulates the multiplexed signal within a 256 QAM waveform (Digital Transmission Channel). The Digital Transmission Channel (DTC) provides a total throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction.

Once the forward error correction is complete the QAM signal is then transmitted to a Ground Satellite Uplink 67 that is operable to transmit the QAM signal within uplink on a frequency ranging from 17.3 to 17.8 GHz to one of the DBS Satellites transponders 84. The DBS Satellite 84 then translates the uplink signal to a frequency between 12.2 and

12.7 GHz, amplifies it and sends it back to earth within the downlink to all subscribers with Satellite Receivers with DBS satellites 84 spot beam.

The signal is the received by the subscribers Satellite Receiver Dish 89 and feed via a downlead to the Satellite Modem/Receiver within the Games Console 82. The QAM signal is then demultiplexed and demodulated by the Satellite Modem/Receiver. The MPEG TS signals are then separated into data, audio and video. The audio and video elementary streams are then buffered in the decoders memory for playback and the data stream is then decoded into its original data form and buffered into the Games Consoles 82 Dynamic Random Access Memory (DRAM).

Using the Random Access Memory (RAM) and the data stored with DRAM the CPU is operable to render the game that is then output via AV lead to the TV 86. Through manipulating the buttons on the Games pad the user is able to play the game. This is advantageous.

In this way the Satellite TV operator is only required to provide one 2-4Mbps MPEG-2 Transport streams per game as opposed to per user to their total subscriber base. For example using the present invention described in the Satellite TV operator could provide a 2-4 Mbps MPEG 2 stream over a Satellite transmission link to all subscribers from which a game could be retrieved on to a STB, Games Console or PC at anytime. This is achieved through transmitting data that is retrieved from the Games Servers 12 Sub storage system and provided continuously over a digital transmission channel. This eliminates the need for a dial up connection and provides a low cost yet high-bandwidth delivery of games to an unlimited number of subscribers. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a user is not required to download an entire game to play. Through BFS a Games Console 82 or PC 88 are operable to access data just as they would from a CD or DVD whereby only the data required for the game level is loaded into the memory. In this way the subscribers does not have to download the entire game onto a hard disc or Personal Video Recorder (PVR) to be played.

Similar to a DVD or CD games system the Games Console 82 or PC 88 will only load what is required from BFS, which is provided continuously within a DTC or FDC. Those skilled in the art will realise that a game is typically realised within the RAM or a Games Console 82 or PC 88.

In this way the BFS acts as storage for all games each with a unique PID identifiable within a unique MPEG-2 Stream that is provided continuously over a Satellite transmission within a DTC. Alternatively data may be provided continuously over Satellite TV operators Transport Network within an out-of-band 6Mhz QPSK Forward Data Channel (FDC). This is advantageous. This may also applied to Set top boxes, which have limited storage capacity.

Through utilising the BFS data may be retrieved and rendered by a Games Console 82, PC 88 or STB 79 without requiring a hard disc, optical disc drive or removable storage. This is achieved through buffering data into DRAM of Games Console 82, PC 88 or STB 79. From which the CPU is operable is render the game through utilising the RAM and data stored in the DRAM. As the subscriber progresses through the game, data is retrieved from the DTC or FDC, which is similar to a DVD or CD usage in a Games Console. Each game is designed to retrieve data from the BFS on instruction which links to specific PID relating to the Game data required.

This removes the necessity for storage capacity on the users device as all the game data may be stored and retrieved from within BFS, which is provided continuously over a DTC or FDC to a users device.

Alternatively the subscriber may be equipped with hard disc which can be utilised by the CPU to store game data retrieved from the BFS. Thereby enabling games to be stored locally on the subscribers Games Console 82, PC 88 or STB 79.

As will be appreciated various formats may be used to transport the game data over a Satellite Transmission or the Transport Network including MPEG-4, DigiCipher II and Raw Transport Data (RTD). Preferably though an MPEG-2 format is used to transport the game data to a user's device. This has the advantage of being supported by the majority of digital TV operators.

According to yet a further aspect of the present invention a subscriber's STB 79, Games Console 82 or PC 88 is operable to retrieve raw data sent in MPEG-2 private sections. This is achieved through transmitting data and video over the same transport stream or when a Games Server 12 does not utilise the BFS. An application resident within the users STB 79, Games Console 82 or PC 88 enables data to be interpreted and a game to be rendered on the users TV screen. In this way the user is able to retrieve data within the MPEG transport stream that can be interpreted by a Games Console, STB or PC to render the game which is the output from the subscribers Games Console, STB and displayed on a TV screen or SVGA for PCs.

The STB 79, Games Console 82 or PC 88 is operable to access data within the MPEG-2 data stream through an utilisation the stream manager a resident application that ensures that the device is tuned into the correct frequency and PID of the game requested by the user.

Referring to figure 4, according to yet a further aspect of the present invention means may be provided whereby software drivers may be provided to Games Consoles 82, PC 88 or STB 79 via a Satellite digital transmission channel (DTC). In this way when a user accesses a digital transmission channel the necessary software drivers to play a game may be provided directly to viewers Games Console 82, PC 88 or STB 79 which may be provided over a Satellite transmission within DTC and stored as resident applications. Alternatively software drivers may be provided via the Transport Network within an out-of-band FDC QPSK signal.

Drivers may include a graphics engine required to render games available on the games system. This is advantageous.

According to yet a further aspect of present invention, means may be provided whereby a user can select and download drivers from GUI. These drivers may be specific to a device that may be connected to viewers Games Console 82, PC 88 or STB 79 to play a game such as an Infrared or USB Games Pad.

Referring to figure 4, according to yet a further aspect of the present invention means may be provided through a GUI whereby a user can select and download multiple games at same time from a Satellite Digital Transmission Channel on to a Games Console 82, PC 88 or STB 79. The data may be stored on a hard disc, personnel video recorder (PVR) or a secondary memory device connected via a USB or Firewire port to a Games Console 82, PC 88 or STB 79. In this way a subscriber may store games locally on their device. This is advantageous.

This is achieved through aggregating several MPEG-2 transport streams each containing data relating to a specific game within one in-band 8 MHz 256-QAM signal. Within one 8 MHz 256-QAM signal there is a maximum of 56 Mbps total data throughput in which each game may be provided within 8 Mbps MPEG-2 streams simultaneously. The user may therefore download up to four games at a rate of 8 Mbps from a single DTC. At a low rate of 3 Mbps allocated to each game up to 18 games may be downloaded at the same time over a single DTC. However at a low rate of 3Mbps the games would take noticeably longer to download.

Alternatively multiple games may be retrieved from an out-of-band QPSK signal via the Satellite TV operators Transport Network which set at 6 MHz would provide a total throughput of 36 Mbps in which several games could be provided. For example means may be provided whereby a subscriber may prompt a GUI provided within a DTC which would enable them to select and highlight multiple games which may be provided over a QPSK signal to a Games Console, STB or PC. Preferably previews of the games may be broadcast or streamed within the GUI thereby enabling the subscriber to preview a game before downloading. This is advantageous.

According to yet a further aspect of the present invention the Command Server 61 is operable to vary the rate of the transport streams in relation to size of game. The rate may be adjusted from 512 Kbps up to 56 Mbps per game within an 6-8Mhz QAM Waveform. This is advantageous.

Referring to figure 4, according to yet a further aspect of the present invention means may be provided whereby a game that a Games Server 12 has provided that to a subscribers Set Top Box (STB) 79 over a Satellite DTC or FDC may be saved. This may provided in number of ways. Firstly means may be provided whereby a Game may saved within the flash memory of a STB 79 as a resident application from which

the subscriber may select and load a game from the point the game was saved. This is advantageous.

For example when a game is saved data is stored on the STB 79 flash memory containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID (PID), service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 and Time stamp that links to specific section of a game.

A resident application on STB 79 is operable to interpret the Game identifier stored in the STB flash memory and search for a specific PID, Channel ID and Time Stamp relating to the saved game. Once the correct PID and Channel ID is established data is then retrieved from the in-band Satellite DTC or out-of-band FDC via a Dial-up DSL Modem to the STB 79 and stored in the flash memory or dynamic random access memory (DRAM). The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively a game may be saved on a USB memory card connected to the STB 79 via the USB port. A resident application on the STB 79 would enable a subscriber to save and load saved games stored on the USB memory card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the USB memory card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams (TS) carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 that links to specific section of a game. For example a PID may include the value 40 which is identifiable with a specific data packet provided within an MPEG TS that relates to the particular level that the game was saved.

A resident application on STB 79 is operable to interpret the PID on the USB memory card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band Satellite DTC or out-of-band FDC via a DSL Modem/receiver to the STB 79 and buffed in the flash memory or dynamic random access memory. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a STB 79 on a Smart card which may be inserted in a smart card drive. The majority of Set-Top Boxes are equipped with multiple smart card drives, which are presently used for conditional access and

authentication. Within the Smart card flash memory, EEPROM or DRAM a games could be saved. A resident application on the STB 79 would enable a subscriber to save and load saved games stored on the Smart card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the Smart card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 that links to specific section of a game. For example a PID may include the value 40 which is identifiable with a specific data packet provided within an MPEG TS that relates to the particular level that the game was saved.

A resident application on STB 79 is operable to interpret the PID on the Smart card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band Satellite DTC or out-of-band FDC via Transport Network to the STB 79 and stored in the flash memory or DRAM. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively means may be provided through a resident application on the STB 79 would enable a subscriber to save and load saved games stored on hard disc or a Personal Video Recorder (PVR). In this way a subscriber may select and load a game from the point the game was saved. Through utilising a hard disc or a Personal Video Recorder (PVR) a subscriber would be able to save a significant number of games. This is advantageous.

When a game is saved data is stored on a hard disc or a Personal Video Recorder (PVR) containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 and Time stamp that links to specific section of a game. For example a PID may include the value 40 which is identifiable with a specific data packet provided within an MPEG TS that relates to the particular level that the game was saved.

A resident application on STB 79 is operable to interpret the PID, Channel ID and Time stamp on the hard disc or PVR and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the DTC or FDC to the STB 79 and stored in the flash memory, hard disc or within the memory on the PVR. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a STB 79 on a Games Server 12 which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a Satellite DTC or FDC which would enable a game to be saved on the Games Server 12. When a game is saved data is stored on Games Server 12 containing a Game ID and Subscriber ID. The Game Identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID (PID), Time Stamp, Service ID, publisher, developer, format and size.

Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game ID also contains a unique value at the end of the PID that links to specific section of a game within a PID ranging from 0 to 255. A resident application on the STB 79 enables a subscriber to select and load a game from the point the game was saved on the Games Server 12 using the data stored in Game Identifier.

For example, referring to figure 4, a subscriber may be watching a video preview of a game provided on a Satellite DTC by the Games Server 12 or QAM Content Servers 29. Within the data stream of the DTC HTML/JavaScript or C++ objects containing triggers are transmitted to the subscriber's STB 79. Using the Middleware engine the STB 79 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen 80 prompting the subscriber to access the games by pressing the red button on the remote control.

If the subscriber responds by pressing the select button on the remote control a signal is then transmitted to the CPU of STB 79. Through software provided on the STB 79 the CPU is operable to interpret the subscribers data input. The CPU then launches a resident application which is operable retrieve HTML, JavaScript or C++ data from the Satellite DTC which is temporally stored in the Dynamic Random Access Memory (DRAM) or Flash Memory of the subscriber's STB 79.

Using a Middleware engine resident on the STB 79 the CPU is operable to render the user interface (UI) using the HTML, XML, JavaScript or C++ objects provided by a Games Server 12, Middleware Server 63 or Proxy Server 72. Those skilled in the art will realise that the UI is typically realised within the RAM of the STB 79.

Preferably video previews of games available may be provided within the user interface. This is achieved through overlaying HTML, Jpeg and GIF graphics provided within the data stream on MPEG video received within the in-band Satellite DTC signal. The video may be defined within HTML parameters of the user interface.

The subscriber is then able to navigate the user interface by manipulating the buttons on the remote control, which is may be interpreted by the CPU and which in turn

highlights the subscriber's selection. Preferably the subscriber is provided the option to select saved games via the remote control.

A resident application on STB 79 is operable to retrieve the PID from the Games Server 12 by constructing a request in response to the subscriber's inputs on the remote control. If the subscribers selects saved games a request formed by the STB 79 which is transmitted upstream by the DSL Modem/Receiver within a 1MHz QPSK waveform, Reverse Data Channel (RDC), to the Hub. QPSK Modems 74 within the Hub are operable to retransmit the data stream to an Asynchronous Transfer Mode (ATM) switch 71 situated on the Transport Network. The ATM switch 71 is operable to route the data stream to second ATM switch 65 that is connected to the Games Server 12 situated at the Head-End via an Ethernet 10/100base-t connection.

The Games Server 12 is operable to retrieve the saved games using the Subscribers ID from a database situated in Head-End and transmit the Game identifier files which are encoded within a MPEG-2 transport stream by an MPEG Encoder 31 as private MPEG section only accessible by authenticated subscriber. The digitised signal is then combined with other data, video and audio streams output by the Games Servers 12 and multiplexed by Multiplexer 30 into a single signal using Time Divisional Multiplexing and Frequency Divisional Multiplexing techniques.

The QAM modulator 68 then modulates the channel within 256 QAM waveform. This provides a data throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction. Once the forward error correction is complete the QAM signal containing the subscribers saved game data is then transmitted to a Ground Satellite Uplink 67. The Ground Satellite Uplink 67 is operable to transmit the QAM signal within uplink on a frequency ranging from 17.3 to 17.8 GHz to one of the DBS Satellites transponders 84. The DBS Satellite 84 then translates the uplink signal to a frequency between 12.2 and 12.7 GHz, amplifies it and sends it back to earth within the downlink to all subscribers with Satellite Receivers with DBS satellites 84 spot beam.

The signal is then received by the Satellite Receiver Dish 81 and feed into the Satellite Modem/receiver within the STB 79 which then demultiplexes and demodulates the incoming signal that is then feed to an MPEG decoder/processor in the STB 79. The MPEG decoder/processor in the STB 79 then decodes the MPEG-2 private transport stream and data is decoded into its original form. The CPU then buffers the data into the flash memory or dynamic random access memory (DRAM).

Using HTML/JavaScript data that is provided with the MPEG-2 private transport stream the STB 79 is operable to render a second user interface using the RAM. The subscriber is then presented with list of saved games within the second user interface. Each saved game listed within the user interface has a unique PID, Channel ID and Service ID stored temporally within the STB 79 memory.

Using the PID, Time Stamp and Channel ID provided within the saved game data through a resident application the CPU is operable to identify and instruct the Satellite

Modem/receiver to switch to the MPEG transport stream containing the PID relating to the subscribers saved game. Upon the subscriber's input the game data is then retrieved by Satellite Modem/receiver from the DTC and buffered into the flash memory or dynamic random access memory of the STB 79.

Using the random access memory the STB 79 is operable to render the game which is then output from the STB 79 via a TV Scart as an analogue signal and displayed on the TV Screen 80. Through manipulating the buttons on the remote control the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

It will be appreciated that the subscribers saved game data may of course be transmitted via a forward data channel (FDC) over the Satellite TV operators network to the subscribers STB 79. This would be achieved through modulating the signal within a 1Mhz QPSK waveform. Those skilled in the art will realise that the data would of course be received via a dial up interface 78 to the STB 79.

Alternatively a saved game executable file may be stored within the STB's 79 flash memory, DRAM or EEPROM as an instruction which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the flash memory, DRAM or EEPROM that may be provided within a user interface of a Game.

For example a subscriber might select a game from the DTC by pressing the red button on their remote control. The game data is then retrieved from the data stream and buffered in to the Set Top Box 79 flash memory or DRAM and realised within the RAM. When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen 80 that is connected to the STB 79 via a Scart lead.

Within the user interface an option to load a game option may be provided. Using the remote control the subscriber may select the load game option. The game then constructs a request that is interpreted by the STB 79 Central Processor Unit (CPU) which is operable to retrieve game data stored within the STB 79 memory resources. The saved game files are then provided within a second user interface as a list of saved games. Through manipulating the buttons on the remote control the subscriber may select a saved game to load. If the subscriber presses select then using the data stored on STB 79 memory resources the game is loaded and the subscriber is able to play the game from the point the game was saved. This is advantageous.

It will be appreciated that the saved game data stored on the STB 79 flash memory, DRAM or EEPROM may contain Game identifiers which as previously described may be used retrieve data stored within the BFS using the PID, Channel ID, Time Stamp and Service ID. This may be necessary for the user to continue playing a game from the point the game was saved depending on the actual byte size of the game.

Referring to figure 4, according to yet a further aspect of the present invention means may be provided whereby a game that a Games Server 12 has provided to a subscribers Games Console 82 over a DTC or FDC may be saved. This may provided in number of ways. Firstly means may be provided whereby a Game may be saved within the memory card of a Games Console 82 as a resident application from which the subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the Games Console 82 memory card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, Packet ID (PID), publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique value and time stamp that links to specific section of a game. For example a PID may include the number 7 which is identifiable with specific data packet provided in the BFS that links to level 12 of a game.

A resident application on Games Console 82 is operable to interpret the PID, Channel ID and Time Stamp on the memory card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band DTC via Satellite Receiver Dish 85 or out-of-band FDC via a DSL Modem/receiver to the Games Console 82 and buffered in the DRAM memory. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively a game may be saved on a USB memory card connected to the Games Console 82 via the USB port. A resident application on the Games Console 82 would enable a subscriber to save and load saved games stored on the USB memory card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the USB memory card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique value ranging from 0 - 255 and a Time stamp that links to specific section of a game.

A resident application on Games Console 82 is operable to interpret the PID, Channel ID, Time Stamp and Service ID on the USB memory card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band DTC via Satellite Receiver Dish 85 or out-of-band FDC via a dial up connection 83 to the Games Console 82 and buffered in the DRAM memory. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby through a resident application on the Games Console 82 this would enable a subscriber to save and load saved games stored on Hard disc or an Optical Disc Drive. In this way a subscriber may select and load a game from the point the game was saved. Through utilising a Hard disc or a Optical Disc Drive a subscriber would be able to save a significant number of games. This is advantageous.

When a game is saved data is stored on a Hard disc or a Optical Disc Drive containing a Game Identifier (GID). The GID contains attributes of the game including, title, time of transmission, channel frequency, channel number, publisher, developer, format and size. The Game Identifier also includes specific Packet Identifier (PID)

Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique number that links to specific section of a game. For example a PID may include the number 7 which is identifiable with the level of a game.

A resident application on Games Console 82 is operable to interpret the GID on the Hard disc or Optical Disc Drive and search for a specific PID, Service ID and Channel ID relating to the saved game. Once the correct PID, Service ID and Channel ID is established data is then retrieved from the DTC via the Satellite Receiver Dish 85 to the Games Console 82 and stored in the Dynamic Random Access Memory, Hard disc or Optical Disc Drive. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Referring to figure 4, according to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a Games Console 82 on a Games Server 12 which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a DTC which would enable a game to saved on the Games Server 12.

A resident application on the Games Console 82 would enable a subscriber to select and load a game from the point the game was saved on the Games Server 12. This may be achieved in a number of ways. Firstly a request may formed by the subscribers Games Console 82 and transmitted upstream via the RDC to Games Server 12 which is operable to retrieve the saved games from a database situated in Head-End and transmit the saved files via the FDC to the subscribers Games Console 82. Once received by the Games Console 82 a game may be loaded.

When a game is saved data is stored on Games Server 12 containing a Game identifier (GID) and Subscriber ID. The GID contains attributes of the game including, title, time of transmission, channel frequency, channel number, MPEG TS identifier, Packet identifier (PID), publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The GID also contains a unique number at the end of the data string that links to specific

section of a game. For example a GID may include a 07 at the end of the address which is identifiable with the level 7 of a game.

A resident application on Games Console 82 is operable to retrieve the PID from the Games Server 12 by constructing a request which is transmitted upstream within a QPSK waveform. The Game Server 12 is operable to interpret the request and using the subscribers ID retrieves the subscribers saved games from a database which is then transmitted of FDC or DTC to the subscribers Games Console 82.

For example, referring to figure 4, a subscriber may be watching a video preview of a game provided on a DTC by the Games Server 12 or QAM Content Servers 57. Within the data stream of the DTC HTML/JavaScript or C++ objects containing triggers are transmitted to the subscriber's Games Console 82. Using the Middleware engine the Games Console 82 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen 86 prompting the subscriber to access the games by pressing the select button on a game pad.

If the subscriber responds by pressing the select button on the game pad a signal is then transmitted to the CPU of Games Console 82. Through software provided on the Games Console 82 the CPU is operable to interpret the subscribers data input. The CPU then launches a resident application which is operable retrieve HTML, JavaScript or C++ data from the DTC which is temporally stored in the Dynamic Random Access Memory (DRAM) of the subscriber's Games Console 82.

Using a Middleware engine resident on the Games Console 82 the CPU is operable to render the user interface (UI) using the HTML, JavaScript or C++ objects provided by a Games Server 12, Middleware Server 63 or Proxy Server 72. Those skilled in the art will realise that the UI is typically realised within the RAM of the Games Console 82.

Preferably video previews of games available may be provided within the user interface. This is achieved through overlaying HTML/C++, Jpeg and GIF graphics provided within the data stream on MPEG video received within the in-band DTC signal. The video may be defined within HTML or C++ parameters of the user interface.

The subscriber is then able to navigate the user interface by manipulating the buttons on the games pad, which is may be interpreted by the CPU and which in turn highlights the subscriber's selection. Preferably the subscriber is provided the option to select saved games via the games pad.

A resident application on Games Console 82 is operable to retrieve the PID from the Games Server 12 by constructing a request in response to the subscriber's inputs on the remote control. If the subscribers selects saved games a request formed by the Games Console 82 which is transmitted upstream by the DSL Modem/Receiver within a 1MHz QPSK waveform, Reverse Data Channel (RDC), to the Hub. QPSK Modems 74

within the Hub are operable to retransmit the data stream to a ATM switch 71 situated on the Transport Network. The ATM switch 71 is operable to route the data stream to second ATM switch 65 that is connected to the Games Server 12 situated at the Head-End via an Ethernet 10/100base-t connection.

The Games Server 12 is operable to retrieve the saved games using the Subscribers ID from a database situated in Head-End and transmit the Game identifier files which are encoded within a MPEG-2 transport stream by an MPEG Encoder 56 as private MPEG section only accessible by authenticated subscriber. The digitised signal is then combined with other data, video and audio streams output by the Games Servers 12 and multiplexed by Multiplexer 30 into a single signal using Time Divisional Multiplexing and Frequency Divisional Multiplexing techniques.

The signal containing the subscribers saved game data is then modulated within 256 QAM waveform by a QAM modulator 68. This provides a data throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction.

Once the forward error correction is complete the QAM signal is then transmitted to a Ground Satellite Uplink 67 that is operable to transmit the QAM signal within uplink on a frequency ranging from 17.3 to 17.8 GHz to one of the DBS Satellites transponders 84. The DBS Satellite 84 then translates the uplink signal to a frequency between 12.2 and 12.7 GHz, amplifies it and sends it back to earth within the downlink to all subscribers with Satellite Receivers with DBS satellites 84 spot beam.

The signal is then received by the Satellite Receiver 85 which is then feed via a downlead to a Satellite Modem/receiver within the Games Console 82 which then demultiplexes and demodulates the incoming signal that is then feed to an MPEG decoder/processor in the Games Console 82. The MPEG decoder/processor in the Games Console 82 then decodes the MPEG stream and data is decoded into its original form. The CPU then buffers the data into the dynamic random access memory (DRAM).

Using HTML/JavaScript data that is provided with the MPEG-2 private transport stream the Games Console 82 is operable to render a second user interface using the RAM. The subscriber is then presented with list of saved games within the second user interface. Each saved game listed within the user interface has a unique PID, Channel ID and Service ID stored temporally within the Games Console 82 memory.

Using the PID, Time Stamp and Channel ID provided within the saved game data through a resident application the CPU is operable to identify and instruct the Satellite Modem/receiver to the correct MPEG transport stream containing the exact data relating to the subscriber selection of a saved game. Upon the subscriber's input the game data is then retrieved by Satellite Modem/receiver from the satellite DTC and buffered into the dynamic random access memory of the Games Console 82.

Using the random access memory the Games Console 82 is operable to render the game which is then output from the Games Console 82 via a S-Video lead as an analogue signal and displayed on the TV Screen 86. Through manipulating the buttons on the games pad the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

It will be appreciated that the subscribers saved game data may of course be transmitted via a forward data channel (FDC) over the Satellite TV operators network to the subscribers Games Console 82. This would be achieved through modulating the signal within a 1Mhz QPSK waveform. Those skilled in the art will realise that the data would of course be received via a dial up interface 83 to the Games Console 82.

Alternatively a saved game executable file may be stored within the Games Console 82 memory card or EEPROM as an instruction which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the memory card or EEPROM that may be provided within a user interface of a Game.

For example a subscriber might select a game from the DTC by pressing the select button on their games controller pad. The game data is then retrieved from the data stream provided within the DTC and buffered in to the Games Console 82 dynamic random access memory (DRAM) and realised within the RAM.

When the game is launched an introductory user interface which may comprise or C++ or HTML/JavaScript objects is presented to the subscriber on the TV screen that is connected to the Games Console 82 via a S-video lead. Within the user interface an option to load a game option may be provided.

Using the games controller pad the subscriber may select the load game option. The game then constructs a request, which is interpreted by the Games Consoles 82 Central Processor Unit (CPU) which is operable to retrieve game data stored within the Games Console 82 memory resources. The saved game files are then provided within a second user interface as a list of saved games. Through manipulating the buttons on the remote the subscriber may select a saved game to load. If the subscriber presses select then using the data stored on memory resources and the Games Consoles 82 RAM the CPU loads the game and the subscriber is able to play the game from the point the game was saved. This is advantageous.

Referring to figure 4, according to yet a further aspect of the present invention means may be provided whereby a game that a Games Server 12 has provided to a subscribers Personal Computer (PC) 88 over a DTC via a Satellite transmission or FDC via dial up connection 87 may be saved. This may provided in number of ways. Firstly through a resident application on the PC 88 this would enable a subscriber to save and load saved games stored on hard disc or an Optical Disc Drive. In this way a subscriber may select and load a game from the point the game was saved. Through

utilising a Hard disc or a Optical Disc Drive a subscriber would be able to save a significant number of games. This is advantageous.

When a game is saved data is stored on a hard disc or an Optical Disc Drive containing a Game identifier (GID). The GID contains attributes of the game including, PID, title, time of transmission, channel frequency, channel number, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The GID also contains a unique value that links to specific section of a game. For example a GID may include the number 7 which is identifiable with level 7 of a game.

A resident application on PC 88 is operable to interpret the PID on the Hard disc or Optical Disc Drive and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the DTC via the Satellite Receiver Dish 89 to the PC 88 and stored in the flash memory, Hard disc or Optical Disc Drive. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Referring to figure 4, according to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a PC 88 on a Games Server 12 which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a DTC or FDC which would enable a game to saved on the Games Server 12.

A resident application on the PC 88 would enable a subscriber to select and load a game from the point the game was saved on the Games Server 12. This may be achieved in a number of ways. Firstly a request may formed by the subscribers PC 88 and transmitted upstream via the RDC to Games Server 12 which is operable to retrieve the saved games from a database situated in Head-End and transmit the saved files via the FDC to the subscribers PC 88. Once received by the PC 88 a game may be loaded.

When a game is saved data is stored on Games Server 12 containing a Program ID (PID) and Subscriber ID. The PID contains attributes of the game including, title, time of transmission, channel frequency, channel number, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique number at the end of the data string that links to specific section of a game. For example a PID may include a 07 at the end of the address which is identifiable with the level of a game.

A resident application stored on the PC 88 is operable to retrieve the PID from the Games Server 12 by constructing a request which is transmitted upstream within a QPSK waveform. The Game server 12 is operable to interpret the request and using the subscribers ID retrieves the subscribers saved games from a database which is then transmitted of FDC or DTC to the subscribers PC 88. The resident application then interprets the PID and searches for the specific PID relating to the saved game.

Once the correct PID is established data is then retrieved from the in-band DTC or out-of-band FDC to the PC 88 and buffered in the DRAM memory or stored on hard disc. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively a saved game executable file may be stored within the PC 88 hard disc or EEPROM as an instruction which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the hard disc or EEPROM that may be provided within a user interface of a Game.

For example a subscriber might select a game from the DTC by pressing the select button on their keyboard or games pad. The game data is then retrieved from the data stream and buffered in to the PC's 88 dynamic random access memory (DRAM) and realised within the RAM. When the game is launched an introductory user interface, that may comprise or C+ or HTML/JavaScript objects, is presented to the subscriber on the SVGA screen that is connected to the PC 88.

Within the user interface an option to load a game option may be provided. Using the games controller pad the subscriber may select the load game option. The game then constructs a request, which is interpreted by the PC's 88 Central Processor Unit (CPU) which is operable to retrieve game data stored within the PC 88 memory resources. The saved game files are then provided within a second user interface as a list of saved games. Through manipulating the buttons on the remote the subscriber may select a saved game to load. If the subscriber presses select then using the data stored on memory resources and the PC 88 RAM the CPU loads the game and the subscriber is able to play the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby through a user interface provided within an in-band DTC or out-of-band FDC a Satellite subscriber can select multi-player networked games using a STB, Games Console or PC and play against other subscribers.

For example, referring to figure 4, a subscriber might access a GUI from an in-band Satellite DTC by pressing the select button on a Games Pad. Data containing HTML and JavaScript objects is then retrieved from the DTC to the Games Consoles 82 memory. Using the HTML and JavaScript objects the Games Console 82 is operable to render the GUI. Those skilled in the art will realise that a GUI is typically realised within the RAM of a Games Console 82.

Within the GUI the subscriber is presented with a list of multi-player networked games including details of number of players, duration of play, game in session, difficulty level, author, publisher and channel.

Preferably MPEG 1 video previews of live multi-player networked games in session may be provided within the user interface. This is achieved by using data inputs retrieved from participating subscribers Games Console, STB or PC within RDC to render the games graphics on Game Server 12 situated in Head-End as described previously in GB 0129161.6 and GB 0203790.1.

Through manipulating the buttons on the Games Pad the subscriber may highlight and select a multi-player networked game to join in. If the subscriber selects a game then a resident application on the Games console 82 switches the Satellite modem/receiver to the correct DTC or FDC relating to the games PID. Data is then retrieved from the DTC or FDC via the Satellite modem/receiver on to Games Console 82 DRAM. The game is then realised within the RAM.

A two-way communication path is then established between the Games Server 12 and Games Console 82 enabling data inputs to be exchange. It will be appreciated that the two-way communication may be formed by two dial up DSL modems performing a handshake and using QPSK modulation to transmit data upstream to Games Server 12 and downstream to the Games Console 82.

Data inputs are then provided to the Games Server 12 within a 1MHz QPSK Waveform initiated by the DVB-S receiver/modem. This provides an Reverse Data Channel (RDC), often referred to as the return path, in which data inputs may be transmitted upstream to a Games Server 12.

Data inputs are then centrally exchanged via the Games Server 12 and each participating subscriber's Games console, PC or STB. Using the Data provided by the Games Server 12 via an in-band DTC signal or out-of-band FDC the Games console 82 is operable to render the game. In this way a subscriber may select and join in a Multi-player network game from GUI provided over an in-band Satellite DTC or out-of-band FDC via a dial up connection. This is advantageous.

It will be appreciated that this method of providing multi-player networked games may be provided to any Satellite TV subscriber with a Games Console, STB or PC equipped with a Satellite Modem/receiver or DSL modem capable of transmitting and receiving data provided over at out-of-band FDC or in-band DTC. This is advantageous.

Referring to figure 4, according to yet a further aspect of the present invention means may be provided whereby sound and music output from the Games Server 12 may be provided by as MPEG audio stream to enhance the user interfaces of a game. It will be appreciated that this may be provided within an in-band digital transmission channel (DTC) or out-of-band forward data channel (FDC).

In this way music or sounds may provided as a signal which may decoded by a receiver within STB 79 and output from a Television set 80 internal or external speakers.

For example, referring to figure 4, a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB 79. The STB 79 Central Processor Unit then interprets the signal and transmits an instruction to the Satellite Modem/receiver that is operable to retrieve data, audio and video from the DTC relating to the Packet Identifier (PID) of the game that was selected. The data is then retrieved from the DTC and buffered into the STB 79 flash memory or DRAM and rendered within the Random Access Memory.

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen 80 that is connected to the STB 79 via a Scart lead. Software on the subscribers STB 79 is operable interpret HTML/JavaScript or C++ instructions provided within the data stream from the DTC via the Satellite Receiver Dish 81. This may include an instruction to decode one or more MPEG audio streams whilst the UI is displayed on the TV screen 80.

Using the PID provided in data instructions the CPU is operable to instruct the Satellite Modem/receiver to switch over the correct MPEG audio stream required. Receiver switches MPEG audio streams and audio is buffered into the MPEG decoder memory. The MPEG decoder then decodes the MPEG audio into an analogue signal that is then output from the subscriber's Television 80 speakers.

In this way music and audio relating to the games UI may then be heard. This enhances the game menus by integrating sound and music without requiring the data to downloaded and stored on the STB 79 flash memory. In addition as the audio or music is provided as MPEG audio stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the audio or music is provided as MPEG audio stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

Of course this may also be used for other applications or user interfaces not relating games including banking, e-mail, electronic program guides, betting and shopping. This is advantageous

According to yet a further aspect of the present invention means may be provided whereby video and audio provided by the Games Server 12 or Common QAM Content Server 57 is combined with data at the subscribers STB, PC or Games Console to enhance a Game's user interfaces. It will be appreciated that the data, video and audio may be provided within an in-band DTC via the Satellite Receiver Dish or within an out-of-band FDC via a dial up connection.

For example, referring to figure 4, a subscriber might select a game from a user interface by pressing the select button on the remote control, which transmits an Infrared radiation signal to the IR port on STB 79. The STB 79 Central Processor Unit then interprets the signal and transmits an instruction to the Satellite modem/receiver that is operable to retrieve data, audio and video from the DTC via Satellite Receiver Dish 81 relating to the Packet ID of the game that was selected. Data, video and audio is then retrieved from the DTC via the Satellite Receiver Dish 81 that is then feed into a Satellite modem/receiver within the STB 79.

The Satellite receiver/modem is then operable to demodulate, demultiplex and remove any forward error correction. Video and audio is then buffered into the MPEG decoder's memory for playback and the data is buffered into the STB flash memory or DRAM.

The video and audio signal are then decoded and decompressed by the MPEG decoder. The decoded video and audio is then output from the subscriber's television screen 80 and the user interface is then rendered over video using the HTML parameters to define the interface graphics.

Video relating to the games user interface (UI) may then be seen in behind the game's menu. In this way video, audio and images may be provided to enhance the UI of a game and enable motion backgrounds. Additionally video and audio may be integrated within a Game's user interface without requiring the data to downloaded and stored on the STB 79 flash memory or DRAM.

Further more as the video is provided as MPEG transport stream and decoded by the STB 79 MPEG decoder/processor this frees up the CPU to carry out other tasks relating to the game interface. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs connected to a Satellite TV provider. Thereby reducing the amount of data required to be downloaded to a users Games Console or PC. This reduces the bandwidth required to provide an enhanced gaming experience thus enabling non-utilised bandwidth to be allocated to provide other services. In addition as the video is provided as MPEG transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

Of course this may also be used for other applications or user interfaces not relating games including banking, e-mail, electronic program guides, betting and shopping. This is advantageous

According to yet a further aspect of the present invention music and audio affects during a game may be provided over an in-band QAM Signal or out-of-band QPSK Signal. It will be appreciated that multiple audio formats may be used by the Game Server to provide sound and music including Dolby Digital Surround Sound, MPEG 1 Layer 3 (MP3) and Audio Compression Level 3 (AC-3).

Through utilising in-band DTC or out-of-band FDC to provide music and audio during a game this reduces processing requirement, which is of particular advantage to a STB that has very little processing capabilities. This is advantageous.

This may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. This is advantageous.

According to yet a further aspect of present invention means may be provided whereby video provided over a in-band digital transmission channel (DTC) is utilised within a game as part games graphics. For example the foreground may be provided over DTC as a data stream and rendered by a STB, Games Console or PC over the video provided within the QAM Signal. Combined with the foreground graphics this then enhances the game quality and reduces the required data to be processed by a STB, Games Console or PC.

According to yet a further aspect of the present invention video provided within in-band DTC and combined with the foreground graphics may be rendered graphics by the Games Server. For example using a graphics engine on the Games Server a games background may be rendered and provided as MPEG video which is then output by the server and combined with data stream by a Multiplexer into a 6 MHz QAM signal which is transmitted to the subscribers STB. It will be appreciated that this may be transmitted via cable, satellite or terrestrial communication paths as previously described in GB 0129161.6 and GB 0203790.1. Within the subscribers STB a MPEG decoder is operable to decode the video stream which is then output on TV screen. Using data also provided within QAM signal and the STB's random access memory, the CPU is operable to render the game's foreground graphics over the video. In this way the STB is not required to render the games background thereby reducing the number of processing transaction required of the CPU and RAM. Through rendering graphics on Games Server the graphics provided during a game can be enhanced to that equal to or greater than current Games console system. This is advantageous.

Additionally through freeing up the CPU and RAM this enables more enhanced graphics to be rendered by the STB including polygons, texture maps and simple 3D objects. This is advantageous. It will be appreciated that the background graphics provided by the Games Server may be pre-rendered thereby not requiring the Games server to render the games background. This is advantageous. In this way the STB, Games Console or PC are not required to process the background data as this is provided as a transmission within a QAM Signal. This is advantageous

Alternatively the background graphics may be provided over an Analogue Transmission Signal (ATC) with Raw Data or transmitted within the out-of-band FDC with compressed digitised data.

According to yet a further aspect of present invention means may be provided whereby video provided over a forward data channel (FDC) is utilised within a game as part games graphics. For example the foreground may be provided over DTC or FDC and rendered by STB, Games Console, PC however video within the FDC QPSK Signal may be utilised as the game background. Combined with the foreground graphics this then enhances the game quality and reduces the required data to be processed by a STB, Games Console or PC.

According to yet a further aspect of the present invention video provided within out-of-band FDC and combined with the foreground graphics may be rendered graphics by the Games Server. For example using a graphics engine on the Games Server a games background may be rendered and provided as MPEG video which is then output by the server and combined with data stream by a Multiplexer into a 6 MHz QPSK signal which is transmitted to the subscribers STB. It will be appreciated that this may be transmitted via cable, satellite or terrestrial communication paths as previously described in Patent GB 0129161.6 and GB 0203790.1. Within the subscribers STB a MPEG decoder is operable to decode the video stream which is then output on TV screen. Using data also provided within QPSK or QAM signal and the STB's random access memory, the CPU is operable to render the game's foreground graphics over the video. In this way the STB is not required to render the games background thereby reducing the number of processing transaction required of the CPU and RAM. Through rendering graphics on Games Server the graphics provided during a game can be enhanced to that equal to or greater than current Games console system. This is advantageous.

Additionally through freeing up the CPU and RAM this enables more enhanced graphics to be rendered by the STB 79 including polygons, texture maps and simple 3D objects. This is advantageous. It will be appreciated that the background graphics provided by the Games Server 12 may be pre-rendered thereby not requiring the Games server 12 to render the games background. This is advantageous. In this way the STB, Games Console or PC are not required to process the background data as this is provided as a transmission within a QPSK Signal. This is advantageous

According to yet a further aspect of the present invention means may be provided whereby video provided over a in-band digital transmission channel (DTC) is utilised within a game to provide full motion cut scenes.

For example a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB 79. The STB 79 Central Processor Unit then interprets the signal and transmits an instruction to the modem/receiver that is operable to retrieve data, audio and video from the DTC relating to the Packet Identifier (PID) of the game that was selected. Data, video and audio are then retrieved from the DTC. The data is then buffered into the STB flash memory and the game is rendered within the random access memory (RAM).

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen that is connected to the STB 79 via a Scart lead. Software on the subscribers STB 79 is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the DTC which may include an instruction to decode one or more MPEG video streams when the subscriber selects play.

An MPEG decoder in the STB 79 is operable to decode the MPEG video provided over the DTC that is then output from the subscriber's television screen. Video relating to the games may then be played on the subscriber's TV screen and subscribers views a video cut scene for the game. This enhances the game by integrating video without requiring the video to downloaded and stored on the STB 79 memory. In addition as the video is provided as MPEG transport stream and decoded by MPEG decoder this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data required to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the video is provided as MPEG transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

According to yet a further aspect of the present invention video output by the Game Server may be provided within a QAM Signal of a Digital Transmission Channel, which may be provided as continuous loop of video whereby random cut scenes are provided when a game is loading between levels.

Alternatively through aggregating several or more 3Mb/s MPEG-2 streams in to a single DTC it is possible to provide non-random cut scenes that are linked to users progress during a game. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby video provided over a out-of-band forward data channel (FDC) is utilised within a game to provide full motion cut scenes. For example a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB 79. The STB 79 Central Processor Unit then interprets the signal and transmits an instruction to the modem/receiver that is operable to retrieve data, audio and video from the FDC relating to the Packet Identifier (PID) of the game that was selected. Data, video and audio are then retrieved from the FDC. The data is then buffered into the STB 79 flash memory and the game is rendered within the random access memory (RAM).

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen that is connected to the STB via a Scart lead. Software on the subscribers STB 79 is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the

DTC which may include an instruction to decode one or more MPEG video streams when the subscriber selects play.

An MPEG decoder in the STB 79 is operable to decode the MPEG video provided over the DTC that is then output from the subscriber's television screen. Video relating to the games may then be played on the subscriber's TV screen and subscribers views a video cut scene for the game. This enhances the game by integrating video without requiring the video to downloaded and stored on the STB 79 flash memory. In addition as the video is provided as MPEG transport stream and decoded by MPEG decoder this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data required to be downloaded to a users Games Console 15 or PC 26 and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the video is provided as MPEG transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

According to yet a further aspect of the present invention video output by the Game Server may be provided within a QAM Signal of a Digital Transmission Channel, which may be provided as continuous loop of video whereby random cut scenes are provided when a game is loading between levels.

Alternatively through aggregating several or more 3Mb/s MPEG-2 streams in to a single 6MHz QPSK FDC it is possible to provide non-random cut scenes that are linked to users progress during a game as will be described. This is advantageous.

Referring to figure 4, according to yet a further aspect of the present invention means may be provided whereby the subscriber's Satellite modem/receiver is operable to switch audio streams on command during a game. Through Channel identifiers, MPEG Transport Stream (TS) Identifiers the subscriber Satellite modem/receiver is also operable to switch DTC, FDC or MPEG TS on command during a game.

It will be appreciated that multiple audio streams may be provided by the Games Server 12 within MPEG Transport streams that may be aggregated into a single DTC or FDC from which the subscriber's receiver is operable to switch between audio streams during a game. This may be achieved through instructions or triggers provided within game data stream or script that provide unique Packet Identities that may be interpreted by the subscriber's receiver that is operable to switch to the correct audio stream provided within DTC or FDC using the Packet identifier (PID).

Alternatively through the use of Program Association Tables the subscribers receiver may be instructed during duration play to switch streams to specific PID. This may be applied to scripted or non-scripted games engine.

For a subscriber's STB, Games Console or PC to receive a particular transport stream, the subscriber's device must first determine the PID being used and then filter packets that have a matching PID value. To help the STB, Games Console or PC identify which PID corresponds to which game, a special set of streams, referred to as Signalling Tables, are transmitted with a description of each game carried within the MPEG-2 Transport Stream.

Signalling tables are sent separately to PES, and are not synchronised with the elementary streams. For example they may be provided through an independent channel. The Program Specific Information (PSI) table in MPEG-2 consists of a description of the elementary streams which need to be combined to build games, and a description of the games.

Each Digital Transmission Channel may contain up to 17 MPEG Transport Streams (TS) with a bit rate of 2Mbps that are aggregated into a single 6MHz in-band QAM signal. Equally each Forward Data Channel may also contain up to 17 Transport Streams (TS) provided at rate of 2Mbps that are aggregated into a single 6MHz out-of-band QPSK signal.

Each MPEG Transport Stream (TS) is unique to each game that is provided by the Games Server 12. Each transport stream consists of several or more elementary streams (ES) that may include Digital Control Data, Digital Audio (sampled and compressed), Digital Video (sampled and compressed) and Digital Data (synchronous, or asynchronous). Each ES provided within MPEG TS can be assigned a unique value from 1 to 255, which are utilised by the subscribers Games Console, PC or STB to identify streams relating to a particular game. It will be appreciated that various Audio samples ranging from sample rates of 16Bps to 365 Kbps may be encoded as elementary steams that are provided with MPEG TS.

Through utilising data triggers within games may utilises bandwidth within a DTC or FDC without requiring to download an entire games data. This is advantageous. Additionally through providing audio within MPEG TS this frees up the CPU within subscribers Games Console, STB or PC to carry out other tasks such as rendering a 3D object. This is advantageous.

For example, referring to figure 4, using remote control the subscriber prompts a game from a digital transmission channel. IR signal transmitted to STB IR port. The CPU interprets instruction and an Instructs the Satellite modem/receiver switch PID to correct MPEG TS relating to the game selected. Data is then retrieved from the MPEG TS and buffered within Dynamic Random Access Memory (DRAM) or Flash Memory of the STB 79.

The CPU then renders the games using Random Access Memory (RAM) that is then feed from the STB 79 via a Scart lead to TV Screen 14. Audio is then buffered into the memory of the MPEG decoder, which operable to demultiplex and demodulate the signal that is then output from the STB 79 via a Scart lead to the TV speakers. The

rendered graphics are then displayed on the subscriber's TV screen 14 and audio is then output through TV speakers. As previously described through manipulating the buttons on the remote control the subscriber is operable to control the game.

During the game an instruction is provided within data stream to switch audio streams to a new PID. The CPU interprets the instruction and instructs the receiver/decoder to switch audio streams to correct PID. The receiver the switches PID audio that is then decoded and output from speakers.

Prior to transportation over a DTC or FDC each ES is input to an MPEG-2 processor, often referred to as a video compressor or encoder, which accumulates the data into a stream of Packetised Elementary Stream (PES) packets. A PES packet may be a fixed or variable sized block, with up to 65536 bytes per block and includes a 6 byte protocol header. The PES protocol header consists of a 3-byte start code followed by a 1-byte stream ID and a 2-byte length field.

Within each MPEG ES additional information about the stream is also provided to assist the decoder at the receiver. This includes a Packetised Elementary Stream (PES) Scrambling Control that defines whether scrambling is used, and the chosen scrambling method, a PES Priority that indicates priority of the current PES packet and a data alignment indicator that indicates if the payload starts with a video or audio start code. Other additional information may include copyright information, indicating if the game within payload is copyright protected. The ES may also include information on whether the ES is an original or a copy of the original ES.

The ES are then combined within MPEG TS before being transported to the Multiplexer 87.
multiplexed by Multiplexer 66 into a single signal using Time Divisional Multiplexing and Frequency Divisional Multiplexing techniques.

The QAM modulator 68 then modulates the channel within 256 QAM waveform. This provides a data throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction. Once the forward error correction is complete the QAM signal containing the subscribers saved game data is then transmitted to a DBS Satellite Uplink 67. DBS Satellite Uplink 67 is operable to transmit the QAM signal to a DBS Satellite 84. The DBS Satellite 84. then amplifies the signal that is then transmitted to all subscribers with Satellite Receivers within the Satellites Spot beam.

The signal is then received by the Satellite Receiver 81 and feed into the Satellite Modem/receiver within the STB 79, which then demultiplexes and demodulates the incoming signal that is then feed to an MPEG decoder/processor in the STB 79. The MPEG decoder/processor in the STB 79 then decodes the MPEG stream relating to PID requested during the game. This is advantageous.

It will be appreciated that the elementary streams may synchronised, or may not be synchronised depending on the task required. For example elementary streams are usually synchronised for digital TV programs, or for digital radio programs to ensure that the audio playback is in synchronism with the corresponding video frames. However the elementary streams may be not synchronised to facilitate the downloading of software or games via a televised program. Those skilled in the art will realise that the subscribers STB, Games Console or PC receiver may achieve synchronisation through utilising time stamps that are provided within the MPEG transport stream.

According to yet a further aspect of the present invention means may be provided whereby remote co processing and assistance graphic processing is provided by the Games Server to enhance 3D and 2D graphics within a game. This is achieved by using data inputs provided by a subscriber's Games Console, PC or STB for the Games Server to render a game.

For example, referring to figure 4, a user may prompt a game from a user interface using the Games Pad. The Satellite Modem/receiver then performs a handshake with a QPSK Modem situated in the Hub ??. This may be DVB-S or TCP/IP based. A two-way communication is then established with the subscribers Games Console 82 Satellite Modem/receiver and Games Servers 12 Satellite Modem. The two-way communication consists of a Forward Path or Forward Data Channel (FDC) and a Reverse Data Channel (RDC).

The Game is then executed on the Games Server 12 and a resident application is launched that enables the user's data inputs to be interpreted by the Games Server 12 Central Processor Unit (CPU). A graphics processor card within the Games Server is operable to output RGB, PAL, NTSC or composite signals from the Games Server 12 to an MPEG encoder 56.

An application resident on the Games Console 82 is operable instruct CPU to transmit users data inputs within RDC which may received by the Games Servers 12 situated that are operable to interpret the users data inputs and render 3D/2D graphics.

Rendered graphics are then output from Games Server 12 graphics card as RGB, PAL, NTSC or composite signal to an MPEG real time encoder (RTE) 56 and encoded and compressed within an MPEG 2 video transport stream in real time. The digital signal is the multiplexed within an in-band Forward Path or out-of-band Forward Data Channel (FDC) by a Multiplexer 66, using Time Divisional Multiplexing (TDM) and Frequency Division Multiplexing (FDM). The signal is modulated into a QPSK waveform or QAM waveform depending on whether the signal is transmitted within an out-of-band FDC.

The signal is then transmitted over the Satellite TV operators transport network that consists of a series of ATM Switches 65,71 connected over layer 12 to 48 optical cables to the hub where signal is then transmitted over Access Network to subscribers Satellite Modem 52.

Alternatively the signal may be transmitted within an in-band forward path as private MPEG stream whereby the signal is transmitted via DBS Satellite 84 to the users Satellite Receiver 85.

The signal is then demultiplexed, demodulated by the Satellite Modem/receiver within Games Console 82 before being buffered into the memory of an MPEG decoder in the Games Console 82 for playback. The signal is the decoded by the MPEG decoder and output from Games Console 82 via a AV lead to TV screen 86.

Through manipulating the buttons on the games pad the user is able to control the game. The data inputs are continuously transmitted within a RDC via the Satellite Modem to Games Server 12 that is operable to render the game. The rendered graphics are the received within an in-band DTC via Satellite Receiver or out-of-band FDC via dial up connection and displayed on the user TV screen 86.

In this way the entire game may be rendered by the Games Server 12 or partially rendered which enables far more complex and detailed 3D scenes to be rendered during a game than supported by a STB, Games Console or PC to be rendered within a game. This is advantageous.

It will be appreciated that the any modem for example a 28 Kbps or 56 Kbps modem may be used by a Games Console, PC or STB to transmit data inputs upstream via return path to Games Server 12 and that any 28 kbps to a 56 kbps modem may be used by the Games Server 12 to receive data inputs.

It will be appreciated that the return path in which data inputs are transmitted upstream to Games Server 12 may also be provided through a Ka-band Satellite Receiver to the Games Server 12 without requiring a dial up connection. This is advantageous.

Figure 5 is an example of a Digital Terrestrial Television (DTT) architecture that may be used to connect subscribers Games Consoles, STBs or PCs to the Games System. Digital Terrestrial Television (DTT) is an alternative to cable television and satellite as a digital telecommunications service that provides television and radio programming and data via Radio Ultra High Frequencies (UHF) and Very High Frequencies (VHF).

Referring to Figure 5 the Terrestrial TV content providers network consists of a Head-End/Data Centre, Transport Network infrastructure/backbone, Hub, Access Network and the subscriber's premises.

The Head-End provides the operational side of TV operator and may include several Game Servers 12, which are operable to output data continuously within the in-band forward path of a DTC via a UHF/VHF link to subscribers Games Consoles, PCs or STBs. Alternatively the Games Server 12 may be configured output data continuously within out-of-band FDC over ATM/OC-3 Transport network to subscribers Games Consoles, PCs or STBs. This is achieved through interfacing the Game Servers 12 with the Head-End network through a PCI System that may be Ethernet, IP or DSL.

The Game Servers 12 may also include an Application Specific Integration (ASI) interface that enables the Game Server 12 to be interfaced with the Transport Network or Head-End. The ASI provides access to several different mechanisms and protocols for delivering data between the Game Server 12 and the Subscribers device regardless of whether a Games Console 109, PC 117 or STB 106. In this way the Game Servers 12 are operable to be directly interfaced with a QAM/QPSK Modulator 89.

Of course there is no reason why the Game Server 12 could not be located in the Hub as illustrated in Patent GB 0203790.1. However as the Games System is designed to transport data through the use of in-band DTC terrestrial signals to a subscribers device and as such from an operational perceptive it is more cost advantageous to centrally situate the Game Servers 12 within the Head-End as illustrated in Figure 5.

Referring to figure 5, the Head-End consists of a Games Servers 12 that are connected to an MPEG Encoder 86 which in turn is connected to a Multiplexer 87. In this way data transmitted by the Game Server 12 may be encoded into MPEG-2 transport streams and transmitted within a in-band QAM digital transmission channel (DTC) or out-of-band QPSK forward data channel (FDC) to a users Games Console, PC or STB.

The MPEG-2 Real-time Encoders (RTE) 86 are operable to compress video and data feeds into MPEG-2 transport streams which are then Multiplexed into a single signal by a Multiplexer 87. The multiplexed signal is than modulated by the QAM/QPSK Modulator 89 into a QAM or QPSK Signal and transmitted via terrestrial link or transport network to a subscriber's device. It will be appreciated that the process of encoding data within an MPEG-2 transport stream may be achieved in real time.

Also connected to the MPEG Encoder 86 by OC-3/OC-12 cable is the Advert insertion server 58, which provides QAM video content over in-band digital transmission channels (DTC) provided by UHF Antenna Transmitter 102 to subscribers UHF Aerials. This may be interconnected with the Game Servers 12 for provisioning TV adverts within Graphical User Interface (GUI) provided by the Game System.

Connected to the Multiplexer 87 is Common QAM Content 88 storage from which TV program content may be retrieved and provided over an in-band DTC or analogue transmission channel (ATC) via a DTT transmission to subscribers UHF Aerials.

Connected to the Multiplexer 87 is a Quadrature Amplitude Modulator (QAM) 89, which provides the in-band forward path for digital transmission channels (DTCs). A DTC is a QAM waveform with a bandwidth of 6 MHz used for transporting MPEG-2 Transport Streams to a UHF Antenna transmitter 98 which is operable to transmit digitised signals to the UHF Amplifier Mast.

The signal is then amplified and transmitted to all subscribers' receivers within the UHF Amplifier Masts signal radius. The signal may be received by an UHF Aerial, which is then feed directly into the Set top box that contains a MPEG decoder and an access

card for the decoder. From the Terrestrial UHF Aerial the signal is then demodulated and demultiplexed before being transported to the MPEG decoder.

The MPEG decoder then applies demodulation and the forward error correction code is removed. The signal is then demultiplexed to enable additional data to be extracted. The compressed data stream is the sent to a buffer from where the compression engine could access it.

The transmission may be DVB-T broadcast-based. Data may be provided over a VHF-Band or UHF-Band signal from a Terrestrial Antenna transmitter to a subscriber's Games Console, STB or PC via an UHF Aerial.

It will be appreciated that as the data is provided continuously over a digital transmission channel may be received by all subscribers Games Consoles, PCs or STBs with DVB-T receiver within the UHF transmitter range which would all be operable to retrieve data packets from the broadcast data stream simultaneously. Thereby reducing the infrastructure cost associated with providing games on demand over broadband.

In the case of asymmetric access to the Games System based on the DVB technology, the user may receive up to 40 Mbps and transmit up to 5 Mbps within the RDC. The receiver protocol is DVB-T. The transport protocols for data transfer are TCP/IP, UDP/IP, FTP, VoIP.

For the DVB-based asymmetric access to the Games System, the UHF Antenna Transmitters use special-purpose equipment, and the receiving users should be equipped with a Terrestrial modem/receiver as a stand-alone unit or a DVB-T receive card integrated with the user's STB 79, Games Console 82 or PC 88. The antenna diameter and the power of the upconverter depend on the link budget based on the required data rate, modem operation modes and terrestrial parameters.

It will be appreciated that various modulations including QPSK and QAM with or without direct sequence spreading may be utilised by the Games Server 12 to provide data to subscribers STB 109, Games Console 106 or PC 117 equipped with a DVB-T receiver at a bit rates up to 140Mbps. This is advantageous.

Referring to Figure 5, connected to the ATM Switch 96 within the Head-End by a Ethernet 10/100Base-T interface is a series of operation support servers consisting of a Time Of Day (TOD) Server 94, a TPFP Server 93, a DHCP/DNS Server 91 and a Billing Server 120. Also connected by an Ethernet interface to the ATM Switch 96 is a Command Server 95, Middleware Server 92 and the Games Server 12. In this way the Command Server 95, Middleware Server 92 or Games Server 12 may receive requests transmitted within the RDC by the subscriber's Games Console 106, PC 117 or STB 109.

The Middleware Server 93, is operable to provide HTML, JavaScript and pJava objects to subscribers STBs, Games Consoles or PCs that may be used to render a graphical user interface (GUI).

It is also possible through HTML and JavaScript objects to command functionality on the device. For example through HTML objects it is possible to command the STB 106 TV functionality such as switching the Terrestrial receiver to a specific frequency to receive incoming data over an in-band DTC MPEG-2 transport stream. As previously described a Middleware engine and HTML, XML Browser resident within the Games Console 109, PC 117 and STB 106 enable HTML, JavaScript and XML objects to be interpreted by the subscriber's device.

Connected to the Middleware Server 93 is a Command Server 95, which is operable to control data streams from the Game Servers 12. Monitoring software and diagnostics software provided on the Command Server 95 enables the TV operator to analysis bandwidth usage and identify problems such as bottlenecks within the network.

Also connected via a 10/100Base-t Ethernet network is a Billing Server 120, which is operable to provide transaction authentication and SSL. Connected to the Billing Server 59 is a Trivial File Transfer Protocol (TFTP) Server 93 which provides modem configuration files that may be used by the Games Console 109, PC 117 or Set Top Box (STB) 106 equipped with Terrestrial Modems/receiver to access the Games System.

A Dynamic Host Configuration Protocol (DHCP) Server 91 provides dynamic assigned IP addresses to the subscribers Games Console 109, PC 117 or STB 106. The DHCP Server 91 also allows the re-use of assigned IP addresses.

A Domain Name System (DNS) Server 91 provides IP addresses to devices connected to the Games System such as the Game Servers 12 or Command Server 95. The DNS Server 91 may also be configured to provide addresses to subscribers and external network devices connected to Internet, enabling subscribers to access content external to the TV network using TCP/IP.

A Time Of Day (TOD) Server 94 provides the synchronisation of native and resident applications on a subscribers device. For example the TOD Server 94 may be utilised to synchronise a program guide with the actual time.

The Middleware Server 92, Command Server 95, Billing Server 120, DHCP Server 91, TFTP Server 93 and TOD Server 94 are all connected via an 10/100Base-t Ethernet network to an Asymmetric Transfer Mode Switch (ATM) 96 that connects the Head-End to the Transport Network infrastructure via Optical cables.

Operation Support System (OSS) software within the Head-End provides Conditional Access (CAM). The hardware upon which the conditional access may be executed may

be a Sun Solaris or Windows NT based workstation that may also be the Billing Server 120.

A QAM Modulator 89 provides the in-band Analogue transmission channels (ATCs). An ATC is an AM-VSB waveform and has a bandwidth of 6 MHz used for transporting an NTSC or PAL signals from the Head-End to a subscribers STB 106, Games Console 109 or PC 117.

A QAM Modulator 89 provides the in-band forward path for digital transmission channels (DTCs). A DTC is a QAM waveform with a bandwidth of 6 MHz used for transporting MPEG-2 Transport Streams from the Head-End to a subscribers STB 106, Games Console 109 or PC 117.

Connected to the QAM modulator 89 is a Asymmetric Transfer Mode Switch (ATM) 96 that connects the Head-End to the Transport Network infrastructure that provides the forward and reverse communication paths.

Referring to Figure 5, the Transport Network infrastructure/backbone consists of numerous Asymmetric Transfer Mode (ATM) Switches interconnected over optical cables such as Optical Carrier Level 12 (OC-12) to 48 (OC-48). The Transport Network infrastructure is operable to support the transmission of data, video and audio over optical cables within out-of-band QPSK Forward Data Channel (FDC) over as Optical Carrier Level 12 to 48 cables to the Hub. QSPK Modems 104 situated at the Hub are operable to transmit the signal over the Access Network via a Pots splitter shelf 103 to a subscriber's STB 106, Games Console 109 or PC 117.

Referring to Figure 5, within the Transport Network optical cables interconnects the ATM switch 96 with a second ATM Switch 98 that connects to the Hub. The Hub consists of Quadrature Phase Shift Keying (QPSK) Modulators 104 that provide the Forward Data Channel (FDC) used for transmitting packets containing IP or MPEG-2 private sections to a users Games Console 109, PC 117 or STB 106.

The FDC is a QPSK waveform with a bandwidth of 1 MHz which may be used for transporting data and various subsystem components from the Hub to a subscribers Games Console, STB or PC over Asymmetric Digital Subscriber Lines (ADSL).

Plain Old Telephone System (POTS) Splitter Shelves 103 interconnect the Hub with the Access Network, which in turn interconnect the subscribers Games Console 109, PC 117 or STB 106 via ADSL cable to the QPSK Modulators 104 within the Hub.

The Access Network often referred to, as the last five miles or the local loop, connects the Hub to the subscribers STB 106, PC 117 or Games Console 109. For Terrestrial TV subscribers this is typically with ADSL/POTS via a dial up modem to subscribers device as illustrated by Figure 5.

Referring to Figure 5, the home subscribers premises includes a UHF Aerial 107 for receiving video, audio and data from a terrestrial link, which is connected to a STB 106 which may used to play games. The subscribers STB 106 includes a standard UHF Aerial 107 operable to receive UHF and VHF Band signals which is connected to a Terrestrial Modem/receiver via a BNC connection. This modem may be a DVB-T based.

Figure 5 also shows a Games Console 109 within the subscribers premises which is also connected to the UHF Aerial 111 via BNC cable, which connects to a Terrestrial receiver/modem contained within the Games Console 109. The a Terrestrial receiver/modem enables data to be received by the Games Console 109 from a UHF or VHF terrestrial signal which may be provided at bit rate of up to 45 Mbps. The Terrestrial receiver/modem is also operable to transmit and receive data from out-of-band QPSK signals via the dial-up connection 83.

Included within each Games Console 109, PC 117 or STB 106 is a resident or native application that is operable to retrieve data received from a QPSK/BPSK out-of-band or in-band UHF/VHF signals using the terrestrial receiver/modem. The application is also operable to buffer data received over an out-of-band or in-band signal into the device memory from which a game may be rendered.

Connected to the Games Console 109 via dial up connection 108 is the Access Network, which contains a series or routers and switches on which data may be transmitted to and from the Hub. Within the Hub a series of QPSK modems 104 provide the out-of-band QPSK Forward data channel (FDC) to a users Games Console 109, PC 117 or STB 106. In this way data packets received over the transport network from a Game Server 12 may be transmitted over the Access network to a users Games Console 109, PC 117 or STB 106 provided within a 1 to 6 MHz QPSK waveform.

The QPSK modems 104 within the Hub are also operable to convert data received from out-of-band QPSK signals transmitted within the Reverse Data Channel (RDC) from a subscribers Terrestrial modem within a Games Console 109, PC 117 or STB 106.

The QPSK modems 104 the Hub are also operable to transmit signals received from the subscribers Games Console 106, PC 117 or STB 109 to the Command Server 95 located in the Head-End of a Terrestrial content provider. Connected to the QPSK modems 104 is an ATM switch 98, which in turn is connected to a series of ATM switches which connect the Hub via the Transport network with a second ATM switch 96 located in the Regional Head-End.

Also connected to the ATM Switch 98 on the Transport Network is a Proxy Servers 99 and Transcoder Servers 97. The Proxy Servers 99 provide HTTP links between the Terrestrial TV network and external networks such as the Internet. The Proxy Server 99 is operable to provide software objects to a subscriber's STB 106, Games Console 109 or PC 117. These objects may be HTML documents, Java applets or XML documents.

The Proxy Server 99 may also provide filtering of requests, translation, and client authentication. A Proxy Server 99 typically uses an IP Gateway to distribute objects to a subscriber's STB 106, Games Console 109 or PC 117. These objects may be HTML or JavaScript objects or other applications.

The Transcoder Servers 97 provides the communication link between the Game Server 12 and subscribers device whether an STB 106, Games Console 109 or PC 117. The Transcoder Server is operable to convert RDC signals received from a DVB Terrestrial Modem in to IP data packets, which may then transmitted over the Transport Network to a Game Server 12, Middleware Server 92 or Proxy Server 99.

Referring to Figure 5, the subscriber's premises includes a STB 106, PC 117 and a Games Console 109 that are connected to the Hub via a dial up modem and Terrestrial receiver. The Terrestrial modem/receiver provides QPSK modulation and demodulation.

Referring to Figure 5, the Games Console 109 consists of 120MB RAM, a 480MHz central processor unit (CPU), 32MB DRAM Memory, Digital Video Disc (DVD) Drive, a 3D Graphics Accelerator chip, Universal Serial Bus (USB) ports, a FireWire port, a 16MB Memory Card, an MPEG-2 decoder, and an Operating System (O/S).

The CPU is operable to interpret and execute instructions. The CPU is used to fetch, decode and to transfer data to and from resources. Data transferred between the Games Consoles 109 resources is transferred over the main data transfer path, the bus, which enables the CPU to command the Games Consoles 82 resources.

Random Access Memory (RAM) often referred to as the volatile memory is a semiconductor based memory that can be read and written by the CPU or other hardware devices. The CPU typically utilises the RAM when rendering a Game.

Dynamic RAM (DRAM) is a type of semiconductor random access memory which may be utilised by the CPU to store and retrieve data. DRAM is typically used during a game acting as a memory buffer with the RAM. Memory buffers hold data temporarily for processing allowing the CPU to access the data at a faster rate than on a DVD or hard disc. DRAM has the advantage of being able to store more data than RAM.

The memory card is a memory module containing random access memory (RAM) semiconductor chips that may be utilised by the CPU to store data or programs. The module may also comprise of EPROM, RAM, ROM or flash memory chips.

Digital Video Disc (DVD) drive is traditionally used by the Games Console 109 to access data, video and audio which has been encoded on a compact disc (CD). A DVD can store greater amounts of data than a traditional CD ranging from 4.7 GB to 17 GB.

The Graphics Card contains a coprocessor, which is a specialised microprocessor that can update graphics on a screen far quicker than a CPU can. The coprocessor is vital

to performance of a Games Console 109 as it able to free up the CPU for other tasks. All present Games Consoles contain a Graphics coprocessor of some kind, which can generate polygons, texture maps, filters and lines in response to instructions from the CPU.

The FireWire (i-Link) port allows external devices to be connected to the Games cotware based or may form part of a Terrestrial TV receiver.

The Universal Serial Bus (USB) ports enables external devices including Games Pads, Joysticks, Steering Wheels, Keyboards, Mousses, Modems and Network adapters to be connected to the Games Console 109.

The Games Console 109 may also include an optional Hard Disc or Optical Disc Drive on which games retrieved from a DTC or FDC may be stored. The Games console 109 is typically connected to users TV screen 111 via an AV lead to a TV Scart port or via AV lead.

Referring to Figure 5, the Games Console 109 is also connected to a dial up connection 105. The dial up connection is utilised by the Terrestrial modem/receiver or V.90 Analogue modem to transmit data over the Access Network to QPSK modems 104 situated at the Hub.

In Figure 5, the Terrestrial modem/receiver is illustrated internal to a Games Console 109, however this may be external to the device through various different interfaces including a USB, Firewire or Ethernet adapter.

Those skilled in the art will realise that the term modem is derivative to that of the term's modulation and demodulation. However the modems described herein are high-speed Terrestrial modems designed for high bandwidth data and video transmissions at bit rates of 4 to 45 Mbps and not 28.8 Kbps analogue modems which most will be familiar with in terms of the Internet.

The Terrestrial modem/receiver is operable to demodulator and modulate signals to and from QPSK modems located within the Hub. The Terrestrial modem/receiver is also operable to retrieve data, video and audio transmitted within a UHF-band or VHF-band terrestrial transmission by QAM Modulator located within the Head-End.

The Terrestrial modem/receiver may be connected to a Games Console 109 via a type III PCMCIA Card slot within the expansion bay. It will be appreciated that various different Interfaces may be used to interface the Terrestrial Modem/receiver including Ethernet 10Base-T, RJ-45 connectors, USB Series B connector, RF Input, 75 Ohm F-Connector. Alternatively a 10/100 Base TX Ethernet card may be used to connect the Games Console 109 to the TV network and in turn the Games Server 12.

A QPSK demodulator within the users Terrestrial modem/receiver is operable to receive IP packets and MPEG-2 private data sections. Using a QPSK demodulator the

Terrestrial modem/receiver is operable to receive data transmitted within a forward data channel (FDC) signal from the Games Server 12. A FDC is a QPSK waveform with a bandwidth of 1 MHz used for transmitting data to a subscriber's device from the Hub. Terrestrial modem/receiver typically utilises one FDC for receiving both application data and instructions at any given time.

A QPSK modulator within the subscriber's Terrestrial modem/receiver provides an out-of-band Reverse Data Channel (RDC). The RDC is also a QPSK waveform with a bandwidth of 1 MHz used for transmitting data from a subscriber's device to the QPSK modems 104 in the Hub.

A Terrestrial modem/receiver typically utilises one RDC for sending both application data and control messages at any given time. Those skilled in the art will realise that the QPSK modems 74 in the Hub may be configured to provide multiple RDC's to one Terrestrial modem/receiver at any given time for providing data inputs and requests from the Games Console 109 to a Game Server 12.

A QAM demodulator within the subscribers Games Console 109 is operable to adapt to channels encoded at different rates of up to 56 Mbps. Thereby enabling data to be received at up to 56 Mbps. In this way data may be retrieved from a QAM in-band DTC signal at a bit rate of 45 Mbps which may be buffered into a Games Consoles 109 memory and rendered through utilising the Random Access Memory (RAM). This is advantageous.

The Games Console 109 and Terrestrial modem/receiver supports the key functions of, audio and video transport stream demultiplexing for Terrestrial broadcasts, source decoding, video encoding/transcoding, streaming audio and video, still imaging, return channel communications, home networking and storage.

Software applications resident on the Games Console 109 facilitate the means of accessing game data over a DTC or FDC from the Terrestrial TV network. The software drivers resident within the Operating System provide the means enabling the Games Console 109 to utilise existing communication paths and infrastructure of a Terrestrial TV network to transmit data upstream to the Games Server 12.

Connected to the Games Console 109 is a Terrestrial UHF Aerial 112, which is operable to receive UHF and VHF-band signals transmitted by a UHF Antenna Transmitter 98. The UHF Aerial 112 is connected to a Terrestrial Modem/receiver via a BNC connection. This modem may be a DVB-T based. In this way games provided by the Games Server 12 within a UHF-band or VHF-band Terrestrial signal may be received by subscribers Games Console 109. This is advantageous.

It will be appreciated that various modulations including QPSK and QAM with or without direct sequence spreading may be utilised by the Games Server 12 to provide data to subscribers Games Console 109 with a DVB-T Terrestrial Modem/receiver at a bit rates up to 140Mbps. This is advantageous.

Connected by a s-video or AV lead to the subscribers Games Console 109 is a TV screen 111 that is operable to display video decoded by an MPEG decoder in the Games console and graphics rendered within the RAM. Alternatively the Games Console 109 may be connected via a S-VHS lead. The TV screen 111 includes speakers from which audio may be output.

Referring to Figure 5, the Set Top Box (STB) 106 consists of an 80MHz Central Processor Unit, 4MB RAM, 2MB Flash Memory, 4MB DRAM, 256 KB EEPROM, 2 Smart card interfaces, 2 USB ports, a Graphics Processor Unit with 4MB SDRAM, an infra-red port, a built-in Modem, an MPEG decoder, an RF Tuner and software.

The CPU is a microprocessor which operable to interpret and execute instructions. The CPU is used to fetch, decode and to transfer data to and from the STB 106 resources. Data is transferred over the STB's 106 main data transfer path, the bus, which enables the CPU to command the STB's 106 resources.

Random Access Memory (RAM) often referred to as the volatile memory is a semiconductor based memory that can be read and written by the CPU or other hardware devices. The CPU typically utilises the RAM when rendering a Game.

Flash Memory is a type of non-volatile memory is built into the STB 106. Flash memory is similar to EEPROM memory in function however data must be removed in blocks. The CPU utilises the flash memory to store data. In this way the Flash Memory acts as a replacement to a hard disc.

Dynamic RAM (DRAM) is a type of semiconductor random access memory which may be utilised by the CPU to store and retrieve data. The CPU utilises the DRAM as a memory buffer for game data. Memory buffers hold data temporarily for processing allowing the CPU to access the data at a faster rate than on a Flash Memory. DRAM has the advantage of being able to store more data than RAM.

Electrically Erasable Programmable read-only Memory (EEPROM) is a type of Erasable Programmable read-only Memory that can be erased with an electrical signal. EEPROM is typically used to store data for long periods without electricity while still allowing reprogramming. EEPROM has less memory than RAM and can only be reprogrammed a limited number of times before wearing out.

The Graphics Processor Unit (GPU) is a coprocessor, which is a specialised microprocessor that can update graphics on a screen far quicker than a CPU can. The coprocessor is vital to performance of a STB 106 as it able to free up the CPU for other tasks. The majority of present Set top boxes contain a Graphics coprocessor of some kind, which can generate polygons, texture maps, filters and lines in response to instructions from the CPU.

The MPEG decoder is operable to decode MPEG-2 streams received from a Terrestrial TV signal. In this way video, audio and data compressed and digitised into an MPEG-2 transport stream and transmitted within an in-band DTC or out-of-band FDC signal can be decoded and interpreted by the CPU. It will be appreciated that the MPEG decoder may of course be software based or may form part of a Terrestrial TV receiver.

The remote control and Infrared interface are standard in all current Set top boxes and are used to relay user commands to the Set top box 106. In this way the user is able to control a game through the manipulation of the buttons on the remote control.

Referring to Figure 5, the STB 106 is also connected to a dial up connection 105. The dial up connection is utilised by the modem to transmit data over the Access Network to QPSK modems 104 situated at the Hub.

The Terrestrial Modem/receiver built in to the STB 106 enables QPSK Waveforms to be received and transmitted. Data may be transmitted through the QPSK modulator which enables the STB to utilise the Reverse Data Channel (RDC) with a QPSK waveform, which in turn provides a return path whereby requests and data inputs maybe transmitted upstream to a Game Server 12, Middleware Server 92 or Proxy Server 99. A QPSK demodulator enables the STB 106 to retrieve data within the out-of-band Forward Data Channel (FDC) provided by the Game Server 12, Middleware Server 92 or Proxy Server 99.

Those skilled in the art will realise that a QPSK Modulator typically located in the Hub is operable to transmit packets containing IP or MPEG private sections over the FDC to the users STB 106. QPSK demodulators present within the hub enable data to be retrieved from the RDC and transported over the transport network to a Games Server 12, Middleware Server 92 or Proxy Server 99.

A QAM demodulator within the STB 106 enables data to be retrieved from within QAM signal provided by the Game Server 12, Middleware Server 92 or Proxy Server 99. QAM signals are QAM waveforms which provides a forward path whereby data, audio and video maybe broadcast via a Terrestrial transmission to all subscribers devices by a Game Server 12, Middleware Server 92 or Proxy Server 99 within a digital transmission channel (DTC).

It will be appreciated that various different protocol specifications may be used including DVB-T (Digital Video Broadcasting Terrestrial), DVB-RCT (Return Channel For Terrestrial) to facilitate the transmission of data within the FDC or RDC.

The STB 106 and Terrestrial Modem/receiver supports the key functions of, audio and video transport stream demultiplexing for Terrestrial broadcasts, source decoding, video encoding/transcoding, streaming audio and video, still imaging, return channel communications, home networking and storage. Software applications provided on the STB 106 facilitate the means of accessing game data over a DTC or FDC from the Terrestrial TV transmission. The software also provides the means enabling the STB to

utilise existing communication paths and infrastructure of a Terrestrial TV network to transmit data upstream to the Games Server 12.

Connected to the Set top box (STB) 106 is a UHF Aerial 107 which is operable to receive UHF and VHF-band signals transmitted by a DTT Antenna 98. The UHF Aerial 107 is connected to a Terrestrial Modem/receiver via a BNC connection. This modem may be a DVB-T based. In this way the subscribers STB 106 may receive games provided by the Games Server 12 within a UHF or VHF-band transmission signals. This is advantageous.

It will be appreciated that various modulations including QPSK and QAM with or without direct sequence spreading may be utilised by the Games Server 12 to provide data to subscribers STB 106 with a DVB-T Terrestrial Modem/receiver at a bit rates up to 140Mbps. This is advantageous.

Connected Set Top Box (STB) 106 via a Scart lead is a TV screen 110 which is operable to display video decoded by a MPEG decoder in the STB 106 and graphics rendered by Graphic Processor Unit (GPU).

Referring to Figure 5, the diagram shows a third subscriber that is connected to the access network via a dial up connection 112 which in turn is connected to a Personnel Computer PC 88.

The Personnel Computer (PC) 117 contains a 1.2 GHz Central Processor Unit, 120MB RAM, 24MB DRAM, 32MB SDRAM, 512KB EEPROM, DVD Drive, 128MB 3D Graphics Accelerator chip, a 40 Gigabyte Hard Disc, an PS2 port, a Modem/receiver, a MPEG-2 decoder and an Operating System (O/S).

The CPU is a silicon based microprocessor which operable to interpret and execute instructions. The CPU is used to fetch, decode and to transfer data to and from resources. Data is transferred over the PC's 117 main data transfer path, the bus, which enables the CPU to command the PC's 117 resources.

Random Access Memory (RAM) often referred to as the volatile memory is a semiconductor based memory that can be read and written by the CPU or other hardware devices. The CPU typically utilises the RAM when rendering a Game.

Dynamic RAM (DRAM) is a type of semiconductor random access memory which may be utilised by the CPU to store and retrieve data. The CPU utilises the DRAM as a memory buffer for game data. Memory buffers hold data temporarily for processing allowing the CPU to access the data at a faster rate than on a DVD or hard disc. DRAM has the advantage of being able to store more data than RAM.

Electrically Erasable Programmable read-only Memory (EEPROM) is a type of Erasable Programmable read-only Memory that can be erased with an electrical signal. EEPROM is typically used to store data for long periods without electricity while still

allowing reprogramming. EEPROM has less memory than RAM and can only be reprogrammed a limited number of times before wearing out.

Digital Video Disc (DVD) drive is traditionally used by the PC 117 to access data, video and audio which has been encoded on a compact disc (CD). A DVD can store greater amounts of data than a traditional CD ranging from 4.7 GB to 17 GB.

The Graphics Card contains a coprocessor, which is a specialised microprocessor that can update graphics on a screen far quicker than a CPU can. The coprocessor is vital to performance of a PC 117 as it able to free up the CPU for other tasks. The majority of present PCs contain a Graphics coprocessor of some kind, which can generate polygons, texture maps, filters and lines in response to instructions from the CPU.

The MPEG decoder is operable to decode MPEG-2 streams received from a Terrestrial TV signal. In this way video, audio and data compressed and digitised into an MPEG-2 transport stream and transmitted within an in-band DTC or out-of-band FDC signal can be decoded and interpreted by the PC 117. The MPEG decoder may be connected to the PC 117 via a PCI slot. It will be appreciated that the MPEG decoder may of course be software based or may form part of a Terrestrial Modem/receiver.

The PS2 interface is standard on all PCs and enables the user to command a game using a keyboard or mouse. In this way the user is able to control a game through manipulating the buttons on the keyboard or mouse, which may be interpreted by a game engine on the PC 117 and the corresponding graphics to users inputs are rendered on the screen. With present PC systems this process can be performed in real time.

According to the present invention subscribers of Terrestrial TV may be provided with USB adapter. The USB would enable a PC 117 to be indirectly interfaced via a USB interface to a DVB-T modem that is operable to connect to the Game Server 12.

According to yet a further aspect of the present invention a PC 117 may be directly interfaced to the Game Server 12 situated with the Head-End via a Terrestrial Modem/receiver or a dial up modem. The Terrestrial Modem/receiver may be connected to a PC 117 via an expansion bay. Alternatively an Ethernet Network Card 10/100Base-t may be used to connect the PC 117 to the Games Server 12.

In this way a PC 117 may access data within the in-band and out-band signals provided by the Games Server 12. In addition through the Terrestrial Modem or a dial up modem the PC 117 may transmit requests or data via the reverse data channel (RDC) upstream to the Game Server 12 with the Head-End. This is advantageous.

Connected to the PC 117 is a UHF Aerial 118 which is operable to receive UHF and VHF-band signals transmitted by a DTT Antenna 98. The UHF Aerial 118 is connected to a Terrestrial Modem/receiver via a BNC connection. The Terrestrial modem/receiver may be a DVB-T based. In this way the subscribers PC 117 may receive games

provided by the Games Server 12 within an UHF or VHF-band terrestrial transmission signals. This is advantageous.

It will be appreciated that various modulations including QPSK and QAM with or without direct sequence spreading may be utilised by the Games Server 12 to provide data to subscribers PC 117 with a DVB-T Terrestrial Modem/receiver at a bit rates up to 140Mbps. This is advantageous.

The PC 117 and Terrestrial Modem/receiver supports the key functions of, audio and video transport stream demultiplexing for Terrestrial broadcasts, source decoding, video encoding/transcoding, streaming audio and video, still imaging, return channel communications, home networking and storage.

Software applications provided on the PC 117 facilitate the means of accessing game data over a DTC or FDC from a Terrestrial transmission or over Terrestrial TV network. The software also provides the means enabling the PC 117 to utilise existing communication paths and infrastructure of a TV network to transmit data upstream to the Games Server 12.

According to the present invention means may be provided whereby a subscriber may trigger a game to download directly relating to video preview of a game provided on a digital transmission channel (DTC) or an analogue transmission channel (ATC) using a Games Console 109, PC 117 or STB 106.

For example, referring to Figure 5, a subscriber may be watching a video preview of a game provided on a DTC by the Games Server 12 or QAM Content Servers 29 in which HTML/JavaScript or C++ objects containing triggers are transmitted to the subscriber's Games Console 109. The CPU in the Games Console 109 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image which is displayed in the top right corner of the TV screen 111 prompting the subscriber to play a game.

Through manipulating the buttons on the Games Pad the subscriber may respond to the prompt. If the subscriber responds by pressing the select button on Games Pad then a signal is then transmitted to the CPU in the Games Console 109. Through software provided on the Games Console 109 the CPU interprets the data input signal and instructs the Terrestrial Modem/receiver connected via PCMCIA slot to switch channels to correct MPEG packet ID (PID) required for the game. The Terrestrial modem then performs a handshake with the Modem Termination System (MTS) situated at the Head-End. This is needed to agree on how to transmit/receive game data and is based on a protocol that defines the type of signalling, frequencies used and authentication.

The game data, which is being transmitted continuously by the Games Server 12 within a DTC, is then received via the UHF Aerial 112 and demodulated by the Terrestrial Modem/receiver. An MPEG Decoder in the Games Console 109 is then operable to

decompress and decode the digitised data stream provided within an MPEG-2 transport stream.

The CPU then buffers the data onto the Games Console 82 Dynamic Random Access Memory (DRAM) and the game is rendered using the RAM. The rendered graphics are then output from the Games Console 109 via an AV-video lead which is connected to a TV Screen 86 upon which the game is displayed. Through manipulating the buttons on the Games Pad the subscriber is operable to control the game. This is advantageous.

Referring to Figure 5, according to yet a further aspect of the present invention subscribers may be provided with a user interface from which the subscriber may select and download games to a STB 106, Games Console 109 or PC 117. This is achieved through transmitting HTML/Java data in the DTC, in-band Forward Path, or an out-of-band forward data channel (FDC) to a users STB 106, Games Console 109 or PC 117.

For example a subscriber may be watching a video preview of a game provided on a DTC by the Games Server 12 or QAM Content Servers 88. Within the data stream of the DTC HTML/JavaScript or C++ objects containing triggers are transmitted via UHF Antenna 98 to the subscriber's UHF Aerial 112 which is then transported to the Games Console 109. Using the Middleware engine the Games Console 109 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen 111 prompting the subscriber to access the games by pressing select button on the game pad.

If the subscriber responds by pressing the select button on the game pad a signal is then transmitted to the CPU of Games Console 109. Through software provided on the Games Console 82 the CPU is operable to interpret the subscribers data input. The CPU then launches a resident application which is operable retrieve HTML, JavaScript, XML or C++ data from the DTC which is temporally stored in the Dynamic Random Access Memory (DRAM) of the subscriber's Games Console 109.

Using a Middleware engine resident on the Games Console 109 is operable to render the user interface (UI) using the HTML, JavaScript or C++ objects provided by a Games Server 12, Middleware Server 92 or Proxy Server 99. Those skilled in the art will realise that the UI is typically realised within the RAM of the Games Console 109.

Preferably video previews of games available may be provided within the user interface. This is achieved through overlaying HTML, Jpeg and GIF graphics provided within the data stream on MPEG video received within the in-band DTC signal. The video may be defined within HTML parameters of the user interface.

The subscriber is then able to navigate the user interface by manipulating the buttons on the game pad, which is may be interpreted by the CPU and which in turn highlights the subscriber's selection. The subscriber then presses the select button on games pad, which sends a signal to the CPU in Games Console 109. The CPU is operable to

interpret the subscribers data input and instructs the Terrestrial Modem/receiver to switch to the correct Channel ID, Service ID and Packet Identity (PID) relating to game selected. The Terrestrial modem/receiver then performs a handshake with a QPSK Modem situated at the Head-End. This is needed to agree on how to transmit/receive game data and is based on a protocol that defines the type of signalling, frequencies and authentication used. For example this protocol may be DVB-T based.

Authentication is provided through the conditional access system that provides a link from the subscriber's device back to the service provider Head-End so that a viewing history can be obtained by the Billing Server 90 for billing purposes. The conditional access system enables the subscriber to utilise pay-per-play services provided by the Games Server 12. The conditional access system is typically provided through a multi-step encryption/decryption scheme. The steps could include DES, RSA and digital signature algorithms.

The conditional access system also provides information that restricts the receiving party to only access games content which it is authorised to view or have agreed to pay for. The conditional access system could also be configured for copy control to prevent taping with games, a regional control may be used to blackout specific regions and a user control for parental control of games.

Once the subscriber is authenticated and the receiving protocol is defined data may then received by the Terrestrial modem/receiver via the Terrestrial Receiver Dish 89. Terrestrial Modem/receiver then receives data output by the Games Server 12 via the Terrestrial Receiver Dish 89 provided within the DTC as MPEG TS. Through an application the Games Console 109 is operable retrieve the data from Terrestrial modem/receiver which is then buffered in to the DRAM of the Games Console 109 from which the game may be rendered.

Those skilled in the art will realise that a game is typically realised within the RAM of a Games Console 109. In this way the subscriber may visually select a game from a user interface by highlighting a game of their choice using a games pad and download the game on to the Games Console 109 memory from which the game may be played. This is advantageous.

Referring to Figure 5, according to yet a further aspect of the present invention game data required by a Games console 109, PC 118 or STB 106 may be stored on the Games server 12 and transmitted continuously or on demand to specific user. This is achieved through interfacing the Game Servers 12 with a QAM Modulator 89, at the Head-End.

For example the Games Server 12 situated within the Head-End may be configured to output game data stored on a hard disc, optical disc, DVD or disk array continuously to as a raw data stream to an Real Time MPEG Encoder (RTE) 86. The RTE 86 is operable to compress and encode the data provided by Games Server 12 into separate MPEG Transport streams that are the multiplexed and combined into single channel by

a Multiplexer 87. The QAM modulator 89 then modulates the channel within 256 QAM waveform. This provides a data throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction.

Once the forward error correction is complete the QAM signal is then transmitted to a UHF Antenna Transmitter 98 that is operable to transmit the QAM signal to a UHF Amplifier Mast 102. The UHF Amplifier Mast 102 then boosts the signal, which then received by the subscribers UHF Aerial 112 within UHF transmission range.

For example a subscriber may be watching a video previews of games provided on a separate QAM digital transmission channel (DTC) by the Games Server 12 or QAM Content Servers 88. Within the data stream of the DTC HTML/JavaScript/XML or C++ objects containing triggers are transmitted via UHF Aerial 112 to the subscriber's Games Console 109. Using the Middleware engine the Games Console 109 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen 111 prompting the subscriber to access the games by pressing select button on the game pad.

If the subscriber responds by pressing the select button on the game pad a signal is then transmitted to the CPU of Games Console 109. Through software provided on the Games Console 109 the CPU is operable to interpret the data input. The CPU then launches a resident application which operable retrieve HTML, JavaScript or C++ data from the DTC which is then temporally stored in the Dynamic Random Access Memory (DRAM) of the subscriber's Games Console 109.

Using a Middleware engine the Games Console 109 is operable to render the user interface (UI) using the HTML, JavaScript, XML or C++ objects provided by a Games Server 12, Middleware Server 92 or Proxy Server 99. Those skilled in the art will realise that the UI is typically realised within the RAM of the Games Console 109.

The subscriber is then able to navigate user interface by manipulating the buttons on the game pad, which is then interpreted by the CPU and the corresponding selection to subscriber's inputs are highlighted on UI which is displayed on the TV Screen 111. The subscriber is then able to select and highlight a game of their choice using the games pad.

The subscriber then selects a game by highlighting a game of their choice and pressing the select button. The CPU then interprets the data input and instructs the DVB-T Terrestrial modem/receiver to switch to correct channel and transport stream identifiable within the PID, SID and Channel ID. The Terrestrial modem/receiver then performs a handshake with the situated at the Head-End. This is needed to agree on how to transmit/receive game data based on a protocol that defines the type of signalling, frequencies used and authentication.

The QAM signal is then received by Terrestrial UHF Aerial 112, which feed to the DVB-T Terrestrial modem/receiver that is contained with the Games Console 109. The Terrestrial modem/receiver is operable to demodulator, demultiplex the QAM signal. The data stream is then separated from audio and video signals. The data signal is then transferred to the MPEG decoder that decodes the data back to its original form and the data is then buffered into DRAM of Game Console 109 from which the game may be rendered.

Using the random access memory the CPU then renders the Game which is then output from the Games Console 109 via an audio and video (AV) lead which is connected to a via TV Scart adapter to the TV Screen 111 upon which the rendered games graphics are displayed. Through manipulating the buttons on the Games Pad the subscriber is operable to control the game. This is advantageous.

In this way games which are output by the Games Server 12 to a QAM Modulator 89 maybe transmitted continuously over a Terrestrial transmission within a DTC from which games maybe downloaded via a user interface onto a Games Console 109, PC 117 or STB 106 at anytime. It will be appreciated that through providing game data over a DTC or ATC the games are being transmitted as a Terrestrial UHF/VHF broadcast, which may be incepted by anyone with a UHF Aerial 112 that is tuned into the right channel signal.

Those skilled in the art will realise that a channel is a separate incoming QAM signal or ATC source that a subscriber can select through a RF tuner. As such the signal has a defined bandwidth with of 6 to 8MHz that may be utilised to provide games to a subscribers Games Console 109, PC 117 or STB 106 equipped with a DVB-T Terrestrial Modem/receiver. Typically a channel will exist within a range of 50-850MHz.

It will be appreciated that all DTC or ATC have bandwidth and that the amount of bandwidth required is only proportional to the size of a game and not the number of users. In a traditional Internet system bandwidth is directly proportional to amount of data transmitted and the numbers of users. This is disadvantageous. It will also be appreciated that through transmitting the game data continuously within a DTC as Terrestrial broadcast only one copy of a game is required to be stored on a Games Server 12. This is advantageous.

According to yet a further aspect of present invention means may be provided whereby up to 20 MPEG-2 transport streams containing game data may be aggregated into one 256-QAM Digital Transmission channel, which may be provided continuously over a Terrestrial Broadcast File System (BFS). This is achieved through combining multiple MPEG-2 data transport streams in to a signal 256-QAM Waveform that may be broadcast to all viewers with equipped with UHF Aerials within a UHF Transmitter 98 transmission range.

It will be appreciated that this may be scaled to suit the TV operator's requirements whereby up 200 MPEG-2 transport streams each containing a different game may be provided continuously over multiple QAM channels. This is advantageous.

Referring to figure 5, according to yet a further aspect of the present invention game data that is stored on the Game Server 12 Storage Subsystem may be transmitted over a variety of links to a subscribers Games Console 109, PC 117 or STB 106. These may include Terrestrial TV Networks Transmissions, IP, IPv6 or ATM or ADSL.

Those skilled in the art will realise that a data transmission may be provided over a simplex or full duplex (using an interaction channel for the return) and may be Unicast (point-to-point), Multicast (one to many) or broadcast (all receivers receiving the assigned PID).

Referring to Figure 5, according to yet a further aspect of the present invention there are five main methods of providing game data within a DTC or FDC to a users Games Console, PC or STB which consist of Data Piping, Data Streaming, Data Carousels or Object Carousels.

Data Piping is a method used by the Games Server 12 to deliver discrete pieces of game data using containers to the destination. Those skilled in the art will realise that typically there is no timing relationship between other (PES) packets and the game data packets.

Data Streaming is a method used by the Game Server 12 to provide game data, which takes the form of a continuous stream that is carried in an asynchronous PES.

Data Carousels is a method that may be used by the Game Server for assembling game data sets into a buffer, which are played-out cyclic manner (periodic transmission). The data sets may be of any format or type i.e. HTML, Java or C++. For example this technique may be used to provide the data for an onscreen On-line Games Guide. The data may be transmitted using fixed sized DSM-CC sections.

A yet further method that may be used by the Game Server 12 to transport data is referred to as an Object Carousel. Object carousels typically resemble data carousels, however they are primarily intended for the broadcast of data services. Those skilled in the art will realise that the data sets are typically defined by the DVB Network Independent Protocol specification and may be used, to down-load data to a Games Console, PC or STB.

Referring to Figure 5, the Terrestrial TV operator network uses a Broadcast File System (BFS) for transporting data repeatedly over the network. This enables the TV operator to provide data such as EPG listings continuously to a STB. Through the present invention the BFS allows Terrestrial TV subscribers equipped with a Games Console 109, PC 117 or STB 109 to quickly access games at anytime without requiring the use of an RDC to request data from the Game Server 12. This mechanism is useful where

large numbers of subscribers require the same game data. An example would be where the same game is made available to any Games Console that has access to the DTC or FDC. This is advantageous.

It will be appreciated that a number of different transport protocols may be used to transmit data over the Transport network to the STB 106, Games console 109 or PC 117 such as Schedule Transfer (ST), ATM, TCP/IP, RTSP and IPTV. Through utilising transport protocols such as ST this provides an optimal data output suitable to transmit game data over a Terrestrial TV operators network or a UHF Transmitter 98 transmission.

Through continuously outputting data from the Game Server 12 over the BFS a subscriber may access and begin to download a game at any point of the data cast regardless of when the user triggers the download. Any data provided within the BFS that is transmitted via in-band QAM or out-of-band QPSK signals may be accessed through a data stream manager resident on the users STB 106, Games Console 109 or PC 117 which is activated on users request.

The data stream manager is a resident application on the user STB 106, Games Consoles 109 or PC 117 that enables game data to be retrieved and interpreted from the BFS into the device DRAM or Flash memory where it is then rendered on a TV Screen. Those skilled in the art will realise that a game is typically realised in the RAM of a device.

For example referring to Figure 5, an application resident on the Games Server 12 is operable retrieve the game data, audio and video that is stored within the Games Server 12 sub storage system. The data, audio and video is then output via an AM Fiber Transport Network or SONET/SDH Transport Network interface to the MPEG Encoder 86. The MPEG Encoder 86 then encoders the data, audio and video into separate elementary streams that are then combined to form individual MPEG Transport Streams. During this process each MPEG TS is assigned a unique PID that is identifiable with a particular game provided within the games systems user interface or channels.

The signal is output from the MPEG Encoder 86 as MPEG TS to a Multiplexer 87 that combines the MPEG TS with other incoming signals using Time Divisional Multiplexing TDM and Frequency Divisional Multiplexing (FDM) techniques. The signal is then output from the Multiplexer 87 to a QAM Modulator 89, which modulates the multiplexed signal within a 256 QAM waveform (Digital Transmission Channel). The Digital Transmission Channel (DTC) provides a total throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction.

Once the forward error correction is complete the QAM signal is then transmitted to a UHF Antenna Transmitter 98 that is operable to transmit the QAM signal to a UHF Amplifier Mast 102. The UHF Amplifier 102 mast then amplifies it and transmits the signal to all subscribers with UHF Aerials within the UHF transmission range.

The signal is the received by the subscribers UHF Aerial 112 and feed via a downlead to the Terrestrial Modem/Receiver within the Games Console 109. The QAM signal is then demultiplexed and demodulated by the Terrestrial Modem/Receiver. The MPEG TS signals are then separated into data, audio and video. The audio and video elementary streams are then buffered in the decoders memory for playback and the data stream is then decoded into its original data form and buffered into the Games Consoles 109 Dynamic Random Access Memory (DRAM).

Using the Random Access Memory (RAM) and the data stored with DRAM the CPU is operable to render the game that is then output via AV lead to the TV 111. Through manipulating the buttons on the Games pad the user is able to play the game. This is advantageous.

In this way the Terrestrial TV operator is only required to provide one 2-4Mbps MPEG-2 Transport streams per game as opposed to per user to their total subscriber base. For example using the present invention described in the Terrestrial TV operator could provide a 2-4 Mbps MPEG 2 stream over a Terrestrial transmission link to all subscribers from which a game could be retrieved on to a STB, Games Console or PC at anytime. This is achieved through transmitting data that is retrieved from the Games Servers 12 Sub storage system and provided continuously over a digital transmission channel. This eliminates the need for a dial up connection and provides a low cost yet high-bandwidth delivery of games to an unlimited number of subscribers. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a user is not required to download an entire game to play. Through BFS a Games Console 109 or PC 117 are operable to access data just as they would from a CD or DVD whereby only the data required for the game level is loaded into the memory. In this way the subscribers does not have to download the entire game onto a hard disc or Personal Video Recorder (PVR) to be played.

Similar to a DVD or CD games system the Games Console 109 or PC 117 will only load what is required from BFS, which is provided continuously within a DTC or FDC. Those skilled in the art will realise that a game is typically realised within the RAM or a Games Console 109 or PC 117.

In this way the BFS acts as storage for all games each with a unique PID identifiable within a unique MPEG-2 Stream that is provided continuously over a Terrestrial transmission within a DTC. Alternatively data may be provided continuously over Terrestrial TV operators Transport Network within an out-of-band 6Mhz QPSK Forward Data Channel (FDC). This is advantageous. This may also applied to Set top boxes, which have limited storage capacity.

This removes the necessity for storage capacity on the users device as all the game data may be stored and retrieved from within BFS, which is provided continuously over

a DTC or FDC to a users device. Alternatively the subscriber may be equipped with hard disc which can be utilised by the CPU to store game data retrieved from the BFS. Thereby enabling games to be stored locally on the subscribers Games Console 109, PC 117 or STB 106. As will be appreciated various formats may be used to transport the game data over a Terrestrial Transmission or the Transport Network including MPEG-4, DigiCipher II and Raw Transport Data (RTD). Preferably though an MPEG-2 format is used to transport the game data to a user's device. This has the advantage of being supported by the majority of digital TV operators.

According to yet a further aspect of the present invention a subscriber's STB 106, Games Console 109 or PC 117 is operable to retrieve raw data sent in MPEG-2 private sections. This is achieved through transmitting data and video over the same transport stream or when a Games Server 12 does not utilise the BFS. An application resident within the users STB 106, Games Console 109 or PC 117 enables data to be interpreted and a game to be rendered on the users TV screen. In this way the user is able to retrieve data within the MPEG transport stream that can be interpreted by a Games Console, STB or PC to render the game which is the output from the subscribers Games Console, STB and displayed on a TV screen or SVGA for PCs. The STB 106, Games Console 109 or PC 117 is operable to access data within the MPEG-2 data stream through an utilisation the stream manager a resident application that ensures that the device is tuned into the correct frequency and PID of the game requested by the user.

Referring to Figure 5, according to yet a further aspect of the present invention means may be provided whereby software drivers may be provided to Games Consoles 109, PC 117 or STB 106 via a Terrestrial digital transmission channel (DTC). In this way when a user accesses a digital transmission channel the necessary software drivers to play a game may be provided directly to viewers Games Console 109, PC 117 or STB 106, which may be provided over a Terrestrial transmission within DTC and stored as resident applications. Alternatively software drivers may be provided via the Transport Network within an out-of-band FDC QPSK signal.

Drivers may include a graphics engine required to render games available on the games system. This is advantageous.

According to yet a further aspect of present invention, means may be provided whereby a user can select and download drivers from GUI. These drivers may be specific to a device that may be connected to viewers Games Console 109, PC 117 or STB 106 to play a game such as an Infrared or USB Games Pad.

Referring to Figure 5, according to yet a further aspect of the present invention means may be provided through a GUI whereby a user can select and download multiple games at same time from a Terrestrial Digital Transmission Channel on to a Games Console 109, PC 117 or STB 106. The data may be stored on a hard disc, personnel video recorder (PVR) or a secondary memory device connected via a USB or Firewire

port to a Games Console 109, PC 117 or STB 106. In this way a subscriber may store games locally on their device. This is advantageous.

This is achieved through aggregating several MPEG-2 transport streams each containing data relating to a specific game within one in-band 8 MHz 256-QAM signal. Within one 8 MHz 256-QAM signal there is a maximum of 56 Mbps total data throughput in which each game may be provided within 8 Mbps MPEG-2 streams simultaneously. The user may therefore download up to four games at a rate of 8 Mbps from a single DTC. At a low rate of 3 Mbps allocated to each game up to 18 games may be downloaded at the same time over a single DTC. However at a low rate of 3Mbps the games would take noticeably longer to download.

Alternatively multiple games may be retrieved from an out-of-band QPSK signal via the Terrestrial TV operators Transport Network which set at 6 MHz would provide a total throughput of 36 Mbps in which several games could be provided. For example means may be provided whereby a subscriber may prompt a GUI provided within a DTC which would enable them to select and highlight multiple games which may be provided over a QPSK signal to a Games Console, STB or PC. Preferably previews of the games may be broadcast or streamed within the GUI thereby enabling the subscriber to preview a game before downloading. This is advantageous.

According to yet a further aspect of the present invention the Command Server 95 is operable to vary the rate of the transport streams in relation to size of game. The rate may be adjusted from 512 Kbps up to 56 Mbps per game within an 6-8Mhz QAM Waveform. This is advantageous.

Referring to Figure 5, according to yet a further aspect of the present invention means may be provided whereby a game that a Games Server 12 has provided that to a subscribers Set Top Box (STB) 106 over a Terrestrial DTC or FDC may be saved. This may provided in number of ways. Firstly means may be provided whereby a Game may saved within the flash memory of a STB 106 as a resident application from which the subscriber may select and load a game from the point the game was saved. This is advantageous.

For example when a game is saved data is stored on the STB 106 flash memory containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID (PID), service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 and Time stamp that links to specific section of a game.

A resident application on STB 106 is operable to interpret the Game identifier stored in the STB flash memory and search for a specific PID, Channel ID and Time Stamp relating to the saved game. Once the correct PID and Channel ID is established data is then retrieved from the in-band Terrestrial DTC or out-of-band FDC via a dial-up

modem to the STB 106 and stored in the flash memory or dynamic random access memory (DRAM). The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively a game may be saved on a USB memory card connected to the STB 106 via the USB port. A resident application on the STB 106 would enable a subscriber to save and load saved games stored on the USB memory card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the USB memory card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams (TS) carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 that links to specific section of a game. For example a PID may include the value 40 which is identifiable with a specific data packet provided within an MPEG TS that relates to the particular level that the game was saved.

A resident application on STB 106 is operable to interpret the PID on the USB memory card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band Terrestrial DTC or out-of-band FDC via a dial up modem to the STB 106 and buffed in the flash memory or dynamic random access memory. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a STB 106 on a Smart card, which may be inserted in a smart card drive. The majority of Set-Top Boxes are equipped with multiple smart card drives, which are presently used for conditional access and authentication. Within the Smart card flash memory, EEPROM or DRAM a games could be saved. A resident application on the STB 106 would enable a subscriber to save and load saved games stored on the Smart card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the Smart card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 that links to specific section of a game. For example a PID may include the value 40 which is identifiable with a specific data packet provided within an MPEG TS that relates to the particular level that the game was saved.

A resident application on STB 106 is operable to interpret the PID on the Smart card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band Terrestrial DTC or out-of-band FDC via Transport Network to the STB 106 and stored in the flash memory or DRAM. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous. Alternatively means may be provided through a resident application on the STB 106 would enable a subscriber to save and load saved games stored on hard disc or a Personal Video Recorder (PVR). In this way a subscriber may select and load a game from the point the game was saved. Through utilising a hard disc or a Personal Video Recorder (PVR) a subscriber would be able to save a significant number of games. This is advantageous.

When a game is saved data is stored on a hard disc or a Personal Video Recorder (PVR) containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game identifier also contains a unique PID value ranging from 0 - 255 and Time stamp that links to specific section of a game. For example a PID may include the value 40 which is identifiable with a specific data packet provided within an MPEG TS that relates to the particular level that the game was saved.

A resident application on STB 106 is operable to interpret the PID, Channel ID and Time stamp on the hard disc or PVR and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the DTC or FDC to the STB 106 and stored in the flash memory, hard disc or within the memory on the PVR. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a STB 106 on a Games Server 12, which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a Terrestrial DTC or FDC which would enable a game to be saved on the Games Server 12. When a game is saved data is stored on Games Server 12 containing a Game ID and Subscriber ID. The Game Identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID (PID), Time Stamp, Service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The Game ID also contains a unique value at the end of the PID that links to specific section of a game within a PID ranging from 0 to 255. A resident application on the STB 106 enables a subscriber to select and load a game from the point the game was saved on the Games Server 12 using the data stored in Game Identifier.

For example, referring to Figure 5, a subscriber may be watching a video preview of a game provided on a Terrestrial DTC by the Games Server 12 or QAM Content Servers

29. Within the data stream of the DTC HTML/JavaScript or C++ objects containing triggers are transmitted to the subscriber's STB 106. Using the Middleware engine the STB 106 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen 110 prompting the subscriber to access the games by pressing the red button on the remote control. If the subscriber responds by pressing the select button on the remote control a signal is then transmitted to the CPU of STB 106. Through software provided on the STB 106 the CPU is operable to interpret the subscribers data input. The CPU then launches a resident application which is operable retrieve HTML, JavaScript or C++ data from the Terrestrial DTC which is temporally stored in the Dynamic Random Access Memory (DRAM) or Flash Memory of the subscriber's STB 106.

Using a Middleware engine resident on the STB 106 the CPU is operable to render the user interface (UI) using the HTML, XML, JavaScript or C++ objects provided by a Games Server 12, Middleware Server 92 or Proxy Server 99. Those skilled in the art will realise that the UI is typically realised within the RAM of the STB 106. Preferably video previews of games available may be provided within the user interface. This is achieved through overlaying HTML, Jpeg and GIF graphics provided within the data stream on MPEG video received within the in-band Terrestrial DTC signal. The video may be defined within HTML parameters of the user interface.

The subscriber is then able to navigate the user interface by manipulating the buttons on the remote control, which is may be interpreted by the CPU and which in turn highlights the subscriber's selection. Preferably the subscriber is provided the option to select saved games via the remote control.

A resident application temporary stored on STB 106 flash memory is operable to retrieve the PID from the Games Server 12 by constructing a request in response to the subscriber's inputs on the remote control. If the subscribers selects saved games a request formed by the STB 106 which is transmitted upstream by the dial up modem within a 1MHz QPSK waveform, Reverse Data Channel (RDC), to the Hub. QPSK Modems 104 within the Hub are operable to retransmit the data stream to an Asynchronous Transfer Mode (ATM) switch 98 situated on the Transport Network. The ATM switch 98 is operable to route the data stream to second ATM switch 96 that is connected to the Games Server 12 situated at the Head-End via an Ethernet 10/100base-t connection.

The Games Server 12 is operable to retrieve the saved games using the Subscribers ID from a database situated in Head-End and transmit the Game identifier files which are encoded within a MPEG-2 transport stream by an MPEG Encoder 86 as private MPEG section only accessible by authenticated subscriber. The digitised signal is then combined with other data, video and audio streams output by the Games Servers 12 and multiplexed by Multiplexer 87 into a single signal using Time Divisional Multiplexing and Frequency Divisional Multiplexing techniques.

The QAM modulator 68 then modulates the channel within 256 QAM waveform. This provides a data throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction. Once the forward error correction is complete the QAM signal containing the subscribers saved game data is then transmitted to a UHF Antenna Transmitter 98. The UHF Antenna Transmitter 98 is operable to transmit the QAM signal to a UHF Amplifier Mast 102. The Amplifier Mast 102 then amplifies the signal that is then transmitted to all subscribers with UHF Aerials within the Amplifier Mast 102 transmission range. The signal is then received by the UHF Aerial 107 and feed into the Terrestrial Modem/receiver within the STB 106, which then demultiplexes and demodulates the incoming signal that is then feed to an MPEG decoder/processor in the STB 106. The MPEG decoder/processor in the STB 106 then decodes the MPEG-2 private transport stream and data is decoded into its original form. The CPU then buffers the data into the flash memory or dynamic random access memory (DRAM).

Using HTML/JavaScript data that is provided with the MPEG-2 private transport stream the STB 106 is operable to render a second user interface using the RAM. The subscriber is then presented with list of saved games within the second user interface. Each saved game listed within the user interface has a unique PID, Channel ID and Service ID stored temporally within the STB 106 memory. Using the PID, Time Stamp and Channel ID provided within the saved game data through a resident application the CPU is operable to identify and instruct the Terrestrial Modem/receiver to switch to the MPEG transport stream containing the PID relating to the subscribers saved game. Upon the subscriber's input the game data is then retrieved by Terrestrial Modem/receiver from the DTC and buffered into the flash memory or dynamic random access memory of the STB 106.

Using the random access memory the STB 106 is operable to render the game which is then output from the STB 106 via a TV Scart as an analogue signal and displayed on the TV Screen 110. Through manipulating the buttons on the remote control the subscriber is able to continue playing the game from the point the game was saved. This is advantageous. It will be appreciated that the subscribers saved game data may of course be transmitted via a forward data channel (FDC) over the Terrestrial TV operators network to the subscribers STB 106. This would be achieved through modulating the signal within a 1Mhz QPSK waveform. Those skilled in the art will realise that the data would of course be received via a dial up connection 105 to the STB 79.

Alternatively a saved game executable file may be stored within the STB's 106 flash memory, DRAM or EEPROM as an instruction, which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the flash memory, DRAM or EEPROM that may be provided within a user interface of a Game. For example a subscriber might select a game from the DTC by pressing the red button on their remote control. The game data is then retrieved from the data stream and buffered in to the Set Top Box 106 flash memory or DRAM and realised within the RAM. When the game is launched an

introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen 110 that is connected to the STB 106 via a Scart lead.

Within the user interface an option to load a game option may be provided. Using the remote control the subscriber may select the load game option. The game then constructs a request that is interpreted by the STB 106 Central Processor Unit (CPU) which is operable to retrieve game data stored within the STB 106 memory resources. The saved game files are then provided within a second user interface as a list of saved games. Through manipulating the buttons on the remote control the subscriber may select a saved game to load. If the subscriber presses select then using the data stored on STB 79 memory resources the game is loaded and the subscriber is able to play the game from the point the game was saved. This is advantageous.

It will be appreciated that the saved game data stored on the STB 79 flash memory, DRAM or EEPROM may contain Game identifiers which as previously described may be used retrieve data stored within the BFS using the PID, Channel ID, Time Stamp and Service ID. This may be necessary for the user to continue playing a game from the point the game was saved depending on the actual byte size of the game.

Referring to Figure 5, according to yet a further aspect of the present invention means may be provided whereby a game that a Games Server 12 has provided to a subscribers Games Console 109 over a DTC or FDC may be saved. This may provided in number of ways. Firstly means may be provided whereby a Game may be saved within the memory card of a Games Console 109 as a resident application from which the subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the Games Console 109 memory card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, Packet ID (PID), publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique value and time stamp that links to specific section of a game. For example a PID may include the number 7 which is identifiable with specific data packet provided in the BFS that links to level 12 of a game.

A resident application on Games Console 109 is operable to interpret the PID, Channel ID and Time Stamp on the memory card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band DTC via UHF Aerial 112 or out-of-band FDC via a DSL Modem/receiver to the Games Console 109 and buffered in the DRAM memory. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous. Alternatively a game may be saved on a USB memory card connected to the Games Console 109 via the USB port. A resident application on the Games Console 109 would enable a subscriber to save and load

saved games stored on the USB memory card. In this way a subscriber may select and load a game from the point the game was saved. This is advantageous.

When a game is saved data is stored on the USB memory card containing a Game identifier. The Game identifier contains attributes of the game including, title, time of transmission, channel frequency, channel ID, packet ID, service ID, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique value ranging from 0 - 255 and a Time stamp that links to specific section of a game. A resident application on Games Console 109 is operable to interpret the PID, Channel ID, Time Stamp and Service ID on the USB memory card and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band DTC via UHF Aerial 112 or out-of-band FDC via a dial up connection 108 to the Games Console 109 and buffered in the DRAM memory. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby through a resident application on the Games Console 109 this would enable a subscriber to save and load saved games stored on Hard disc or an Optical Disc Drive. In this way a subscriber may select and load a game from the point the game was saved. Through utilising a Hard disc or a Optical Disc Drive a subscriber would be able to save a significant number of games. This is advantageous.

When a game is saved data is stored on a Hard disc or a Optical Disc Drive containing a Game Identifier (GID). The GID contains attributes of the game including, title, time of transmission, channel frequency, channel number, publisher, developer, format and size. The Game Identifier also includes specific Packet Identifier (PID) Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique number that links to specific section of a game. For example a PID may include the number 7 which is identifiable with the level of a game.

A resident application on Games Console 109 is operable to interpret the GID on the Hard disc or Optical Disc Drive and search for a specific PID, Service ID and Channel ID relating to the saved game. Once the correct PID, Service ID and Channel ID is established data is then retrieved from the DTC via the UHF Aerial 112 to the Games Console 109 and stored in the Dynamic Random Access Memory, Hard disc or Optical Disc Drive. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Referring to Figure 5, according to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a Games Console 109 on a Games Server 12 which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a DTC which would enable a game to saved on the Games Server 12.

A resident application on the Games Console 109 would enable a subscriber to select and load a game from the point the game was saved on the Games Server 12. This may be achieved in a number of ways. Firstly a request may formed by the subscribers Games Console 109 and transmitted upstream via the RDC to Games Server 12 which is operable to retrieve the saved games from a database situated in Head-End and transmit the saved files via the FDC to the subscribers Games Console 109. Once received by the Games Console 109 a game may be loaded.

When a game is saved data is stored on Games Server 12 containing a Game identifier (GID) and Subscriber ID. The GID contains attributes of the game including, title, time of transmission, channel frequency, channel number, MPEG TS identifier, Packet identifier (PID), publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The GID also contains a unique number at the end of the data string that links to specific section of a game. For example a GID may include a 07 at the end of the address which is identifiable with the level 7 of a game.

A resident application on Games Console 109 is operable to retrieve the PID from the Games Server 12 by constructing a request, which is transmitted upstream within a QPSK waveform. The Game Server 12 is operable to interpret the request and using the subscribers ID retrieves the subscribers saved games from a database, which is then transmitted of FDC or DTC to the subscribers Games Console 109.

For example, referring to Figure 5, a subscriber may be watching a video preview of a game provided on a DTC by the Games Server 12 or QAM Content Servers 57. Within the data stream of the DTC HTML/JavaScript or C++ objects containing triggers are transmitted to the subscriber's Games Console 109. Using the Middleware engine the Games Console 109 is operable to interpret the HTML/JavaScript or C++ objects and through utilising Random Access Memory (RAM) is operable to render a graphic image. The graphic image is then displayed in the top right corner of the TV screen 111 prompting the subscriber to access the games by pressing the select button on a game pad.

If the subscriber responds by pressing the select button on the game pad a signal is then transmitted to the CPU of Games Console 109. Through software provided on the Games Console 109 the CPU is operable to interpret the subscribers data input. The CPU then launches a resident application which is operable retrieve HTML, JavaScript or C++ data from the DTC which is temporally stored in the Dynamic Random Access Memory (DRAM) of the subscriber's Games Console 109.

Using a Middleware engine resident on the Games Console 109 the CPU is operable to render the user interface (UI) using the HTML, JavaScript or C++ objects provided by a Games Server 12, Middleware Server 92 or Proxy Server 99. Those skilled in the art will realise that the UI is typically realised within the RAM of the Games Console 109. Preferably video previews of games available may be provided within the user

interface. This is achieved through overlaying HTML/C++, Jpeg and GIF graphics provided within the data stream on MPEG video received within the in-band DTC signal. The video may be defined within HTML or C++ parameters of the user interface.

The subscriber is then able to navigate the user interface by manipulating the buttons on the games pad, which is may be interpreted by the CPU and which in turn highlights the subscriber's selection. Preferably the subscriber is provided the option to select saved games via the games pad.

A resident application on Games Console 109 is operable to retrieve the PID from the Games Server 12 by constructing a request in response to the subscriber's inputs on the remote control. If the subscribers selects saved games a request formed by the Games Console 109 which is transmitted upstream by the DSL Modem/Receiver within a 1MHz QPSK waveform, Reverse Data Channel (RDC), to the Hub. QPSK Modems 104 within the Hub are operable to retransmit the data stream to a ATM switch 98 situated on the Transport Network. The ATM switch 98 is operable to route the data stream to second ATM switch 96 that is connected to the Games Server 12 situated at the Head-End via an Ethernet 10/100base-t connection.

The Games Server 12 is operable to retrieve the saved games using the Subscribers ID from a database situated in Head-End and transmit the Game identifier files which are encoded within a MPEG-2 transport stream by an MPEG Encoder 86 as private MPEG section only accessible by authenticated subscriber. The digitised signal is then combined with other data, video and audio streams output by the Games Servers 12 and multiplexed by Multiplexer 30 into a single signal using Time Divisional Multiplexing and Frequency Divisional Multiplexing techniques. The signal containing the subscribers saved game data is then modulated within 256 QAM waveform by a QAM modulator 68. This provides a data throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error Correction. Once the forward error correction is complete the QAM signal is then transmitted to the UHF Antenna Transmitter 98. The UHF Antenna Transmitter 98 is operable to transmit the QAM signal to a UHF Amplifier Mast 102. The Amplifier Mast 102 then amplifies the signal that is then transmitted to all subscribers with UHF Aerials within the Amplifier Mast 102 transmission range.

The signal is then received by the UHF Aerial 112 that is then feed via a downlead to a Terrestrial Modem/receiver within the Games Console 109 that then demultiplexes and demodulates the incoming signal that is then feed to an MPEG decoder/processor in the Games Console 109. The MPEG decoder/processor in the Games Console 109 then decodes the MPEG stream and data is decoded into its original form. The CPU then buffers the data into the dynamic random access memory (DRAM). Using HTML/JavaScript data that is provided with the MPEG-2 private transport stream the Games Console 109 is operable to render a second user interface using the RAM. The subscriber is then presented with list of saved games within the second user interface. Each saved game listed within the user interface has a unique PID, Channel ID and Service ID stored temporally within the Games Console 109 memory.

Using the PID, Time Stamp and Channel ID provided within the saved game data through a resident application the CPU is operable to identify and instruct the Terrestrial Modem/receiver to the correct MPEG transport stream containing the exact data relating to the subscriber selection of a saved game. Upon the subscriber's input the game data is then retrieved by Terrestrial Modem/receiver from the terrestrial DTC and buffered into the dynamic random access memory of the Games Console 109.

Using the random access memory the Games Console 109 is operable to render the game which is then output from the Games Console 109 via a Audio and Video (AV) lead as an analogue signal and displayed on the TV Screen 111. Through manipulating the buttons on the games pad the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

It will be appreciated that the subscribers saved game data may of course be transmitted via a forward data channel (FDC) over the Terrestrial TV operators network to the subscribers Games Console 109. This would be achieved through modulating the signal within a 1Mhz QPSK waveform. Those skilled in the art will realise that the data would of course be received via a dial up interface 108 to the Games Console 109. Alternatively a saved game executable file may be stored within the Games Console 109 memory card or EEPROM as an instruction which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the memory card or EEPROM that may be provided within a user interface of a Game.

For example a subscriber might select a game from the DTC by pressing the select button on their games controller pad. The game data is then retrieved from the data stream provided within the DTC and buffered in to the Games Console 109 dynamic random access memory (DRAM) and realised within the RAM. When the game is launched an introductory user interface which may comprise or C++ or HTML/JavaScript objects is presented to the subscriber on the TV screen that is connected to the Games Console 109 via a AV lead. Within the user interface an option to load a game option may be provided.

Using the games controller pad the subscriber may select the load game option. The game then constructs a request, which is interpreted by the Games Consoles 109 Central Processor Unit (CPU) which is operable to retrieve game data stored within the Games Console 109 memory resources. The saved game files are then provided within a second user interface as a list of saved games. Through manipulating the buttons on the remote the subscriber may select a saved game to load. If the subscriber presses select then using the data stored on memory resources and the Games Consoles 109 RAM the CPU loads the game and the subscriber is able to play the game from the point the game was saved. This is advantageous.

Referring to Figure 5, according to yet a further aspect of the present invention means may be provided whereby a game that a Games Server 12 has provided to a

subscribers Personal Computer (PC) 117 over a DTC via a Terrestrial transmission or FDC via dial up connection 116 may be saved. This may provided in number of ways. Firstly through a resident application on the PC 117 this would enable a subscriber to save and load saved games stored on hard disc or an Optical Disc Drive. In this way a subscriber may select and load a game from the point the game was saved. Through utilising a Hard disc or a Optical Disc Drive a subscriber would be able to save a significant number of games. This is advantageous.

When a game is saved data is stored on a hard disc or an Optical Disc Drive containing a Game identifier (GID). The GID contains attributes of the game including, PID, title, time of transmission, channel frequency, channel number, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The GID also contains a unique value that links to specific section of a game. For example a GID may include the number 7 which is identifiable with level 7 of a game.

A resident application on PC 117 is operable to interpret the PID on the Hard disc or Optical Disc Drive and search for a specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the DTC via the UHF Aerial 118 to the PC 117 and stored in the flash memory, Hard disc or Optical Disc Drive. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Referring to Figure 5, according to yet a further aspect of the present invention means may be provided whereby a subscriber may save a game played on a PC 117 on a Games Server 12 which would be held remotely on a database. Means may provided through a graphical user interface within a Game or provided over a DTC or FDC which would enable a game to saved on the Games Server 12.

A resident application on the PC 117 would enable a subscriber to select and load a game from the point the game was saved on the Games Server 12. This may be achieved in a number of ways. Firstly a request may formed by the subscribers PC 117 and transmitted upstream via the RDC to Games Server 12 which is operable to retrieve the saved games from a database situated in Head-End and transmit the saved files via the FDC to the subscribers PC 117. Once received by the PC 117 a game may be loaded.

When a game is saved data is stored on Games Server 12 containing a Program ID (PID) and Subscriber ID. The PID contains attributes of the game including, title, time of transmission, channel frequency, channel number, publisher, developer, format and size. Each PID is unique to a game and may be addressable from MPEG-2 transport streams carried within the BFS. The PID also contains a unique number at the end of the data string that links to specific section of a game. For example a PID may include a 07 at the end of the address which is identifiable with the level of a game.

A resident application stored on the PC 117 is operable to retrieve the PID from the Games Server 12 by constructing a request which is transmitted upstream within a QPSK waveform. The Game server 12 is operable to interpret the request and using the subscribers ID retrieves the subscribers saved games from a database which is then transmitted of FDC or DTC to the subscribers PC 117. The resident application then interprets the PID and searches for the specific PID relating to the saved game. Once the correct PID is established data is then retrieved from the in-band DTC or out-of-band FDC to the PC 117 and buffered in the DRAM memory or stored on hard disc. The game is then realised in RAM and the subscriber is able to continue playing the game from the point the game was saved. This is advantageous.

Alternatively a saved game executable file may be stored within the PC 117 hard disc or EEPROM as an instruction which is executable on the launch of a game. Each game is operable to interpret the instruction thereby enabling game to load to a specific level or a point at which the subscriber selected save. A game may also be operable to retrieve saved files within the hard disc or EEPROM that may be provided within a user interface of a Game. For example a subscriber might select a game from the DTC by pressing the select button on their keyboard or games pad. The game data is then retrieved from the data stream and buffered in to the PC's 117 dynamic random access memory (DRAM) and realised within the RAM. When the game is launched an introductory user interface, that may comprise or C+ or HTML/JavaScript objects, is presented to the subscriber on the SVGA screen that is connected to the PC 117.

Within the user interface an option to load a game option may be provided. Using the games controller pad the subscriber may select the load game option. The game then constructs a request, which is interpreted by the PC's 117 Central Processor Unit (CPU) which is operable to retrieve game data stored within the PC 117 memory resources. The saved game files are then provided within a second user interface as a list of saved games. Through manipulating the buttons on the remote the subscriber may select a saved game to load. If the subscriber presses select then using the data stored on memory resources and the PC 117 RAM the CPU loads the game and the subscriber is able to play the game from the point the game was saved. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby through a user interface provided within an in-band DTC or out-of-band FDC a Terrestrial subscriber can select multi-player networked games using a STB, Games Console or PC and play against other subscribers. For example, referring to Figure 5, a subscriber might access a GUI from an in-band Terrestrial DTC by pressing the select button on a Games Pad. Data containing HTML and JavaScript objects is then retrieved from the DTC to the Games Consoles 117 memory. Using the HTML and JavaScript objects the Games Console 117 is operable to render the GUI. Those skilled in the art will realise that a GUI is typically realised within the RAM of a Games Console 117. Within the GUI the subscriber is presented with a list of multi-player networked games including details of number of players, duration of play, game in session, difficulty level, author, publisher and channel. Preferably MPEG 1 video previews of live

multi-player networked games in session may be provided within the user interface. This is achieved by using data inputs retrieved from participating subscribers Games Console, STB or PC within RDC to render the games graphics on Game Server 12 situated in Head-End as described previously in GB 0203790.1.

Through manipulating the buttons on the Games Pad the subscriber may highlight and select a multi-player networked game to join in. If the subscriber selects a game then a resident application on the Games console 117 switches the Terrestrial modem/receiver to the correct DTC or FDC relating to the games PID. Data is then retrieved from the DTC or FDC via the Terrestrial modem/receiver on to Games Console 109 DRAM. The game is then realised within the RAM.

A two-way communication path is then established between the Games Server 12 and Games Console 82 enabling data inputs to be exchange. It will be appreciated that the two-way communication may be formed by two dial up DSL modems performing a handshake and using QPSK modulation to transmit data upstream to Games Server 12 and downstream to the Games Console 109. Data inputs are then provided to the Games Server 12 within a 1MHz QPSK Waveform initiated by the DVB-T receiver/modem. This provides an Reverse Data Channel (RDC), often referred to as the return path, in which data inputs may be transmitted upstream to a Games Server 12.

Data inputs are then centrally exchanged via the Games Server 12 and each participating subscriber's Games console, PC or STB. Using the Data provided by the Games Server 12 via an in-band DTC signal or out-of-band FDC the Games console 109 is operable to render the game. In this way a subscriber may select and join in a Multi-player network game from GUI provided over an in-band Terrestrial DTC or out-of-band FDC via a dial up connection. This is advantageous. It will be appreciated that this method of providing multi-player networked games may be provided to any Terrestrial TV subscriber with a Games Console, STB or PC equipped with a Terrestrial Modem/receiver or DSL modem capable of transmitting and receiving data provided over at out-of-band FDC or in-band DTC. This is advantageous.

Referring to Figure 5, according to yet a further aspect of the present invention means may be provided whereby sound and music output from the Games Server 12 may be provided by as MPEG audio stream to enhance the user interfaces of a game. It will be appreciated that this may be provided within an in-band digital transmission channel (DTC) or out-of-band forward data channel (FDC). In this way music or sounds may provided as a signal which may decoded by a receiver within STB 106 and output from a Television set 110 internal or external speakers. For example, referring to Figure 5, a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB 106. The STB 106 Central Processor Unit then interprets the signal and transmits an instruction to the Terrestrial Modem/receiver that is operable to retrieve data, audio and video from the DTC relating to the Packet Identifier (PID) of the game that was

selected. The data is then retrieved from the DTC and buffered into the STB 106 flash memory or DRAM and rendered within the Random Access Memory.

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen 110 that is connected to the STB 106 via a Scart lead. Software on the subscribers STB 79 is operable interpret HTML/JavaScript or C++ instructions provided within the data stream from the DTC via the UHF Aerial 112. This may include an instruction to decode one or more MPEG audio streams whilst the UI is displayed on the TV screen 111.

Using the PID provided in data instructions the CPU is operable to instruct the Terrestrial Modem/receiver to switch over the correct MPEG audio stream required. Receiver switches MPEG audio streams and audio is buffered into the MPEG decoder memory. The MPEG decoder then decodes the MPEG audio into an analogue signal that is then output from the subscriber's Television 111 speakers.

In this way music and audio relating to the games UI may then be heard. This enhances the game menus by integrating sound and music without requiring the data to downloaded and stored on the STB 106 flash memory. In addition as the audio or music is provided as MPEG audio stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the audio or music is provided as MPEG audio stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous. Of course this may also be used for other applications or user interfaces not relating games including banking, e-mail, electronic program guides, betting and shopping. This is advantageous

According to yet a further aspect of the present invention means may be provided whereby video and audio provided by the Games Server 12 or Common QAM Content Server 117 is combined with data at the subscribers STB, PC or Games Console to enhance a Game's user interfaces. It will be appreciated that the data, video and audio may be provided within an in-band DTC via the UHF Aerial 112 or within an out-of-band FDC via a dial up connection.

For example, referring to Figure 5, a subscriber might select a game from a user interface by pressing the select button on the remote control, which transmits an Infrared radiation signal to the IR port on STB 106. The STB 106 Central Processor Unit then interprets the signal and transmits an instruction to the Terrestrial modem/receiver that is operable to retrieve data, audio and video from the DTC via Terrestrial UHF Aerial 112 relating to the Packet ID of the game that was selected. Data, video and audio is then retrieved from the DTC via the Terrestrial UHF Aerial 112 that is then feed into a Terrestrial modem/receiver within the STB 109.

The Terrestrial receiver/modem is then operable to demodulate, demultiplex and remove any forward error correction. Video and audio is then buffered into the MPEG decoder's memory for playback and the data is buffered into the STB flash memory or DRAM. The video and audio signal are then decoded and decompressed by the MPEG decoder. The decoded video and audio is then output from the subscriber's television screen 110 and the user interface is then rendered over video using the HTML parameters to define the interface graphics.

Video relating to the games user interface (UI) may then be seen in behind the game's menu. In this way video, audio and images may be provided to enhance the UI of a game and enable motion backgrounds. Additionally video and audio may be integrated within a Game's user interface without requiring the data to downloaded and stored on the STB 106 flash memory or DRAM. Further more as the video is provided as MPEG transport stream and decoded by the STB 106 MPEG decoder/processor this frees up the CPU to carry out other tasks relating to the game interface. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs connected to a Terrestrial TV provider. Thereby reducing the amount of data required to be downloaded to a users Games Console or PC. This reduces the bandwidth required to provide an enhanced gaming experience thus enabling non-utilised bandwidth to be allocated to provide other services. In addition as the video is provided as MPEG transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous. Of course this may also be used for other applications or user interfaces not relating games including banking, e-mail, electronic program guides, betting and shopping. This is advantageous

According to yet a further aspect of the present invention music and audio affects during a game may be provided over an in-band QAM Signal or out-of-band QPSK Signal. It will be appreciated that multiple audio formats may be used by the Game Server to provide sound and music including Dolby Digital Surround Sound, MPEG 1 Layer 3 (MP3) and Audio Compression Level 3 (AC-3).

Through utilising in-band DTC or out-of-band FDC to provide music and audio during a game this reduces processing requirement, which is of particular advantage to a STB that has very little processing capabilities. This is advantageous. This may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. This is advantageous.

According to yet a further aspect of present invention means may be provided whereby video provided over a in-band digital transmission channel (DTC) is utilised within a game as part games graphics. For example the foreground may be provided over DTC as a data stream and rendered by a STB, Games Console or PC over the video provided within the QAM Signal. Combined with the foreground graphics this then

enhances the game quality and reduces the required data to be processed by a STB, Games Console or PC.

According to yet a further aspect of the present invention video provided within in-band DTC and combined with the foreground graphics may be rendered graphics by the Games Server. For example using a graphics engine on the Games Server a games background may be rendered and provided as MPEG video which is then output by the server and combined with data stream by a Multiplexer into a 6 MHz QAM signal which is transmitted to the subscribers STB. It will be appreciated that this may be transmitted via cable, satellite or terrestrial communication paths as previously described in GB 0129161.6 and GB 0203790.1. Within the subscribers STB a MPEG decoder is operable to decode the video stream which is then output on TV screen. Using data also provided within QAM signal and the STB's random access memory, the CPU is operable to render the game's foreground graphics over the video. In this way the STB is not required to render the games background thereby reducing the number of processing transaction required of the CPU and RAM. Through rendering graphics on Games Server the graphics provided during a game can be enhanced to that equal to or greater than current Games console system. This is advantageous.

Additionally through freeing up the CPU and RAM this enables more enhanced graphics to be rendered by the STB including polygons, texture maps and simple 3D objects. This is advantageous. It will be appreciated that the background graphics provided by the Games Server may be pre-rendered thereby not requiring the Games server to render the games background. This is advantageous. In this way the STB, Games Console or PC are not required to process the background data as this is provided as a transmission within a QAM Signal. This is advantageous. Alternatively the background graphics may be provided over an Analogue Transmission Signal (ATC) with Raw Data or transmitted within the out-of-band FDC with compressed digitised data.

According to yet a further aspect of present invention means may be provided whereby video provided over a forward data channel (FDC) is utilised within a game as part games graphics. For example the foreground may be provided over DTC or FDC and rendered by STB, Games Console, PC however video within the FDC QPSK Signal may be utilised as the game background. Combined with the foreground graphics this then enhances the game quality and reduces the required data to be processed by a STB, Games Console or PC.

According to yet a further aspect of the present invention video provided within out-of-band FDC and combined with the foreground graphics may be rendered graphics by the Games Server. For example using a graphics engine on the Games Server a games background may be rendered and provided as MPEG video which is then output by the server and combined with data stream by a Multiplexer into a 6 MHz QPSK signal which is transmitted to the subscribers STB. It will be appreciated that this may be transmitted via cable, satellite or terrestrial communication paths as previously described in GB 0129161.6 and GB 0203790.1. Within the subscribers STB a MPEG

decoder is operable to decode the video stream which is then output on TV screen. Using data also provided within QPSK or QAM signal and the STB's random access memory, the CPU is operable to render the game's foreground graphics over the video. In this way the STB is not required to render the games background thereby reducing the number of processing transaction required of the CPU and RAM. Through rendering graphics on Games Server the graphics provided during a game can be enhanced to that equal to or greater than current Games console system. This is advantageous.

Additionally through freeing up the CPU and RAM this enables more enhanced graphics to be rendered by the STB 106 including polygons, texture maps and simple 3D objects. This is advantageous. It will be appreciated that the background graphics provided by the Games Server 12 may be pre-rendered thereby not requiring the Games server 12 to render the games background. This is advantageous. In this way the STB, Games Console or PC are not required to process the background data as this is provided as a transmission within a QPSK Signal. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby video provided over a in-band digital transmission channel (DTC) is utilised within a game to provide full motion cut scenes.

For example a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB 106. The STB 106 Central Processor Unit then interprets the signal and transmits an instruction to the modem/receiver that is operable to retrieve data, audio and video from the DTC relating to the Packet Identifier (PID) of the game that was selected. Data, video and audio are then retrieved from the DTC. The data is then buffered into the STB flash memory and the game is rendered within the random access memory (RAM).

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen that is connected to the STB 106 via a Scart lead. Software on the subscribers STB 106 is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the DTC which may include an instruction to decode one or more MPEG video streams when the subscriber selects play.

An MPEG decoder in the STB 106 is operable to decode the MPEG video provided over the DTC that is then output from the subscriber's television screen. Video relating to the games may then be played on the subscriber's TV screen and subscribers views a video cut scene for the game. This enhances the game by integrating video without requiring the video to downloaded and stored on the STB 106 memory. In addition as the video is provided as MPEG transport stream and decoded by MPEG decoder this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data required to be downloaded to a users Games Console or PC and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the video is provided as MPEG transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

According to yet a further aspect of the present invention video output by the Game Server may be provided within a QAM Signal of a Digital Transmission Channel, which may be provided as continuous loop of video whereby random cut scenes are provided when a game is loading between levels. Alternatively through aggregating several or more 3Mb/s MPEG-2 streams in to a single DTC it is possible to provide non-random cut scenes that are linked to users progress during a game. This is advantageous.

According to yet a further aspect of the present invention means may be provided whereby video provided over a out-of-band forward data channel (FDC) is utilised within a game to provide full motion cut scenes. For example a subscriber might select a game from a user interface by pressing the select button on the remote control which transmits an Infrared radiation signal to the IR port on STB 106. The STB 106 Central Processor Unit then interprets the signal and transmits an instruction to the modem/receiver that is operable to retrieve data, audio and video from the FDC relating to the Packet Identifier (PID) of the game that was selected. Data, video and audio are then retrieved from the FDC. The data is then buffered into the STB 106 flash memory and the game is rendered within the random access memory (RAM).

When the game is launched an introductory user interface which may comprise or HTML or JavaScript objects is presented to the subscriber on the TV screen that is connected to the STB via a Scart lead. Software on the subscribers STB 106 is operable interpret HTML/JavaScript or C+ instructions provided within the data stream from the DTC which may include an instruction to decode one or more MPEG video streams when the subscriber selects play.

An MPEG decoder in the STB 106 is operable to decode the MPEG video provided over the DTC that is then output from the subscriber's television screen. Video relating to the games may then be played on the subscriber's TV screen and subscribers views a video cut scene for the game. This enhances the game by integrating video without requiring the video to downloaded and stored on the STB 106 flash memory. In addition as the video is provided as MPEG transport stream and decoded by MPEG decoder this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

It will be appreciated that this may also be applied to Games Consoles and PCs. Thereby reducing the required amount of data required to be downloaded to a users Games Console 109 or PC 117 and which in turn reduces the bandwidth need which can be utilised to provide other services. In addition as the video is provided as MPEG

transport stream this frees up the CPU to carry out other tasks relating to the game. This is advantageous.

According to yet a further aspect of the present invention video output by the Game Server may be provided within a QAM Signal of a Digital Transmission Channel, which may be provided as continuous loop of video whereby random cut scenes are provided when a game is loading between levels. Alternatively through aggregating several or more 3Mb/s MPEG-2 streams in to a single 6MHz QPSK FDC it is possible to provide non-random cut scenes that are linked to users progress during a game as will be described. This is advantageous.

Referring to Figure 5, according to yet a further aspect of the present invention means may be provided whereby the subscriber's Terrestrial modem/receiver is operable to switch audio streams on command during a game. Through Channel identifiers, MPEG Transport Stream (TS) Identifiers the subscriber Terrestrial modem/receiver is also operable to switch DTC, FDC or MPEG TS on command during a game.

It will be appreciated that multiple audio streams may be provided by the Games Server 12 within MPEG Transport streams that may be aggregated into a single DTC or FDC from which the subscriber's receiver is operable to switch between audio streams during a game. This may be achieved through instructions or triggers provided within game data stream or script that provide unique Packet Identities that may be interpreted by the subscriber's receiver that is operable to switch to the correct audio stream provided within DTC or FDC using the Packet identifier (PID). Alternatively through the use of Program Association Tables the subscribers receiver may be instructed during duration play to switch streams to specific PID. This may be applied to scripted or non-scripted games engine.

For a subscriber's STB, Games Console or PC to receive a particular transport stream, the subscriber's device must first determine the PID being used and then filter packets that have a matching PID value. To help the STB, Games Console or PC identify which PID corresponds to which game, a special set of streams, referred to as Signalling Tables, are transmitted with a description of each game carried within the MPEG-2 Transport Stream.

Signalling tables are sent separately to PES, and are not synchronised with the elementary streams. For example they may be provided through an independent channel. The Program Specific Information (PSI) table in MPEG-2 consists of a description of the elementary streams which need to be combined to build games, and a description of the games. Each Digital Transmission Channel may contain up to 17 MPEG Transport Streams (TS) with a bit rate of 2Mbps that are aggregated into a single 6MHz in-band QAM signal. Equally each Forward Data Channel may also contain up to 17 Transport Streams (TS) provided at rate of 2Mbps that are aggregated into a single 6MHz out-of-band QPSK signal.

Each MPEG Transport Stream (TS) is unique to each game that is provided by the Games Server 12. Each transport stream consists of several or more elementary streams (ES) that may include Digital Control Data, Digital Audio (sampled and compressed), Digital Video (sampled and compressed) and Digital Data (synchronous, or asynchronous). Each ES provided within MPEG TS can be assigned a unique value from 1 to 255, which are utilised by the subscribers Games Console, PC or STB to identify streams relating to a particular game. It will be appreciated that various Audio samples ranging from sample rates of 16Bps to 365 Kbps may be encoded as elementary steams that are provided with MPEG TS.

Through utilising data triggers within games may utilises bandwidth within a DTC or FDC without requiring to download an entire games data. This is advantageous. Additionally through providing audio within MPEG TS this frees up the CPU within subscribers Games Console, STB or PC to carry out other tasks such as rendering a 3D object. This is advantageous. For example, referring to Figure 5, using remote control the subscriber prompts a game from a digital transmission channel. IR signal transmitted to STB 106 IR port. The CPU interprets instruction and an Instructs the Terrestrial modem/receiver switch PID to correct MPEG TS relating to the game selected. Data is then retrieved from the MPEG TS and buffered within Dynamic Random Access Memory (DRAM) or Flash Memory of the STB 106.

The CPU then renders the games using Random Access Memory (RAM) that is then feed from the STB 106 via a Scart lead to TV Screen 110. Audio is then buffered into the memory of the MPEG decoder, which operable to demultiplex and demodulate the signal that is then output from the STB 106 via a Scart lead to the TV speakers. The rendered graphics are then displayed on the subscriber's TV screen 110 and audio is then output through TV speakers. As previously described through manipulating the buttons on the remote control the subscriber is operable to control the game.

During the game an instruction is provided within data stream to switch audio streams to a new PID. The CPU interprets the instruction and instructs the receiver/decoder to switch audio streams to correct PID. The receiver the switches PID audio that is then decMPEG ES additional information about the stream is also provided to assist the decoder at the receiver. This includes a Packetised Elementary Stream (PES) Scrambling Control that defines whether scrambling is used, and the chosen scrambling method, a PES Priority that indicates priority of the current PES packet and a data alignment indicator that indicates if the payload starts with a video or audio start code. Other additional information may include copyright information, indicating if the game within payload is copyright protected. The ES may also include information on whether the ES is an original or a copy of the original ES. The ES are then combined within MPEG TS before being transported to the Multiplexer 87. The Multiplexer 87 then multiplexes the MPEG TS, through applying Time Divisional Multiplexing and Frequency Divisional Multiplexing techniques.

The QAM modulator 68 then modulates the channel within 256 QAM waveform. This provides a data throughput of 38.8 Mb/s with 188/204 Reed Salmon Forward Error

Correction. Once the forward error correction is complete the QAM signal containing the subscribers saved game data is then transmitted to a UHF Antenna Transmitter 98. The UHF Antenna Transmitter 98 is operable to transmit the QAM signal to a UHF Amplifier Mast 102. The Amplifier Mast 102 then amplifies the signal that is then transmitted to all subscribers with UHF Aerials within the Amplifier Mast 102 transmission range.

The signal is then received by the UHF Aerial 107 and feed into the Terrestrial Modem/receiver within the STB 106, which then demultiplexes and demodulates the incoming signal that is then feed to an MPEG decoder/processor in the STB 106. The MPEG decoder/processor in the STB 106 then decodes the MPEG stream relating to PID requested during the game. This is advantageous.

It will be appreciated that the elementary streams may or may not be synchronised depending on the task required. For example elementary streams are usually synchronised for digital TV programs, or for digital radio programs to ensure that the audio playback is in synchronism with the corresponding video frames. However the elementary streams may be not synchronised to facilitate the downloading of software or games via a televised program. Those skilled in the art will realise that the subscribers STB, Games Console or PC receiver may achieve synchronisation through utilising time stamps that are provided within the MPEG transport stream.

According to yet a further aspect of the present invention means may be provided whereby remote co processing and assistance graphic processing is provided by the Games Server 12 to enhance 3D and 2D graphics within a game. This is achieved by using data inputs provided by a subscriber's Games Console, PC or STB for the Games Server 12 to render a game. For example, referring to Figure 5, a user may prompt a game from a user interface using the Games Pad. The Terrestrial Modem/receiver then performs a handshake with a QPSK Modem situated in the Hub. This may be DVB-T or TCP/IP based. A two-way communication is then established with the subscribers Games Console 109 Terrestrial Modem/receiver and Games Servers 12 Modem. The two-way communication consists of a Forward Path or Forward Data Channel (FDC) and a Reverse Data Channel (RDC).

The Game is then executed on the Games Server 12 and a resident application is launched that enables the user's data inputs to be interpreted by the Games Server 12 Central Processor Unit (CPU). A graphics processor card within the Games Server 12 is operable to output RGB, PAL, NTSC or composite signals from the Games Server 12 to an MPEG encoder 56. An application resident on the Games Console 109 is operable instruct CPU to transmit the user's data inputs within RDC which may received by the Games Servers 12 situated at the Head-End. The Games Server 12 is operable to interpret the users data inputs and render 3D/2D graphics using onboard graphics processor or a PCI, AGP Graphics card processor.

The rendered graphics are then output from Games Server 12 graphics card or a video-out interface as RGB, PAL, NTSC or composite signal to an MPEG real time encoder

(RTE) 56 and encoded and compressed within an MPEG 2 video transport stream in real time. The digital signal is the multiplexed within an in-band Forward Path or out-of-band Forward Data Channel (FDC) by a Multiplexer 87, using Time Divisional Multiplexing (TDM) and Frequency Division Multiplexing (FDM). The signal is modulated into a QPSK waveform or QAM waveform depending on whether the signal is transmitted within an out-of-band FDC.

The signal is then transmitted over the Terrestrial TV operators transport network that consists of a series of ATM Switches 96,98 connected over layer 12 to 48 optical cables to the hub where signal is then transmitted over Access Network to subscribers Terrestrial Modem. Alternatively the signal may be transmitted within an in-band forward path as private MPEG stream whereby the signal is transmitted via UHF Transmitter 98 to the users UHF Aerial 112. The signal is then demultiplexed, demodulated by the Terrestrial Modem/receiver within Games Console 109 before being buffered into the memory of an MPEG decoder in the Games Console 109 for playback. The signal is the decoded by the MPEG decoder and output from Games Console 109 via a AV lead to TV screen 111.

Through manipulating the buttons on the games pad the user is able to control the game. The data inputs are continuously transmitted within a RDC via the Terrestrial Modem to Games Server 12 that is operable to render the game. The rendered graphics are the received within an in-band DTC via Terrestrial Receiver or out-of-band FDC via dial up connection and displayed on the user TV screen 111. In this way the entire game may be rendered by the Games Server 12 or partially rendered which enables far more complex and detailed 3D scenes to be rendered during a game than supported by a STB, Games Console or PC within a game. This is advantageous.

It will be appreciated that the any low bit rate analogue modem may be used by a Games Console, PC or STB to transmit data inputs upstream via return path to Games Server 12. For example a V.30 or V.90 analogue modem may be used for the RDC. In addition it will also be appreciate that any low bit rate analogue modem may be used by the Games Server 12 to receive data inputs including a V.30 or V.90 modem ranging at bit rate of 14 kbps to 128 kbps. This is advantageous.

CLAIMS

1. A video games system comprising of a user terminal having a screen, means of receiving data, video and audio from a transmission channel or non transmission in which a video game is provided by a Games Server within a signal may be retrieved, loaded, rendered and displayed on a screen by the user terminal using the user's terminal memory to play a game provided by a Game Server on a digital TV network.

2. A video games system as claimed in Claim 1, wherein a game may be provided by a Games Server using a digital transmission channel to a plurality of users terminals, the user terminals with the means to receive a video game from a digital transmission channel including but not limited to a set top box, Games Console or Personal Computer.

3. A video games system as claimed in Claim 1 or Claim 2, wherein a user terminal is operable to receive a video game from a Games Server located remotely on a digital TV network is operable to output and transmit video games data via a digital transmission channel to a user's terminal.

4. A video games system as claimed in Claim 1, Claim 2 or Claim 3, wherein a user terminal is operable to receive a video game from a Games Server located remotely on a digital TV network is operable to output and transmit video games data via a non transmission channel to a user's terminal.

5. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game from a Games Server located remotely on a digital TV network is operable to output and transmit video games data via a forward data channel to user's terminal.

6. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game from a Games Server located remotely on a cable TV network is operable to output and transmit video games data via a digital transmission channel to a user's terminal.

7. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game from a Games Server located remotely on a cable TV network is operable to output and transmit video games data via a non transmission channel to a user's terminal.

8. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game from a

Games Server located remotely on a cable TV network is operable to output and transmit video games data via a forward data channel to a user's terminal.

9. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game from a Games Server located remotely on a satellite TV network is operable to output and transmit video games data via a digital transmission channel to a user's terminal.

10. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game from a Games Server located remotely on a satellite TV network is operable to output and transmit video games data via a non transmission channel to a user's terminal.

11. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game from a Games Server located remotely on a satellite TV network is operable to output and transmit video games data via a forward data channel to a user's terminal.

12. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game from a Games Server located remotely on a terrestrial TV network is operable to output and transmit video games data via a digital transmission channel to a user's terminal.

13. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game from a Games Server located remotely on a terrestrial TV network is operable to output and transmit video games data via a non transmission channel to a user's terminal.

14. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game from a Games Server located remotely on a terrestrial TV network is operable to output and transmit video games data via a forward data channel to a user's terminal.

15. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game through a DVB-S receiver/modem may be connected to a user's terminal via a type III PCMCIA Port or via a USB or Firewire port is operable to download video games from a DTC provided by a Games Server.

16. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game through a DVB-S receiver/modem may be connected to a user terminal via a PCI Port.

17. A video games system as claimed in any one of the proceeding claims, wherein a user terminal is operable to receive a video game through a DVB-S interface which is operable to receive digital signals from a GEO satellite and isolate channels containing game data and convert the digital signal to an analogue format, and checks for errors from which the game data may be retrieved and stored in the memory resource of a users terminal that may consist of a Games Consoles, STB or PC.

18. A video games system as claimed in any one of the proceeding claims, wherein games data provided by a Games Server may be directly broadcast to subscribers Games Consoles, Set Top Box or Personal Computer via a wide swath by geostationary orbit (GEO) satellites.

19. A video games system as claimed in any one of the proceeding claims, wherein games data provided by a Games Server may be directly broadcast to subscribers Games Consoles via a wide swath by geostationary orbit (GEO) satellites which is feed via a coax cable to a satellite modem within a Games Console in which a Central Processor Unit is operable to buffer the data into a game console's memory and the Game is rendered using the random access memory (RAM).

20. A video games system as claimed in any one of the proceeding claims, wherein games data provided by a Games Server may be directly broadcast to subscribers Personal Computer via a wide swath by geostationary orbit (GEO) satellites which is feed via a coax cable to a satellite modem within a Personal Computer in which a Central Processor Unit is operable to buffer the data into the subscribers Personal Computer's memory and the Game is rendered using the random access memory (RAM).

21. A video games system as claimed in any one of the proceeding claims, wherein games data provided by a Games Server may be directly broadcast to subscribers Set top box via a wide swath by geostationary orbit (GEO) satellites which is feed via a coax cable to a satellite modem within a Set top box in which a Central Processor Unit is operable to buffer the data into the subscribers Set top box memory and the Game is rendered using the random access memory (RAM).

22. A video games system as claimed in any one of the proceeding claims, wherein satellite bands may be used when transmitting game data from a Games Server over a satellite including but not limited to C-Band, Ka-Band and Ku-Band which may provide data rates for downloading a game to a user's terminal of up to 45 Mbps per signal.

23. A video games system as claimed in any one of the proceeding claims, wherein a Games System is operable to transmit games data from a Game Server on a digital TV network using a GEO Satellite to a subscribers Games Console, PC or STB using various transmission bands including, S-Band, L-Band, V-Band, VHF-Band, UHF-Band and X-Band.

24. A video games system as claimed in any one of the proceeding claims, wherein a method of providing a return path from a user's Set top box, Games Console or PC to the Game Server consists of using Ka-band Satellites.

25. A video games system as claimed in any one of the proceeding claims, wherein the a Games System is operable to transmit games data from a Game Server through the transmission of data by a Satellite Modulator over a forward data channel.

26. A video games system as claimed in any one of the proceeding claims, wherein a user terminal may access the Games and Games Server through the DVB-Satellite Return Channel (DVB-RCS) protocol specification to transmit data over DSL to the Hub thereby providing the reverse data channel (RDC) to a Games Server.

27. A video games system as claimed in any one of the proceeding claims, wherein a user terminal may access the Games and Games Server through the a plurality transport protocols including IEEE 802.14, DVB-RC Return Channel thereby providing the return path to a Games Server.

28. A video games system as claimed in any one of the proceeding claims, wherein Games System is operable to transmit games data from a Game Server through using a plurality of transmission protocols including but not limited to TCP/IP, UDP, HTTP and IP may be used to transmit data over a QPSK, BPSK or a QAM signal to a Games Console, PC or STB.

29. A video games system as claimed in any one of the proceeding claims, wherein the Game Servers consists of rack-mountable computer chassis features a passive backplane, slots for peripheral and hot swappable CPU modules, RAM, DRAM, SDRAM, VNRAM, multiple network interface input/outputs (I/O), V.90 modem, DVB-C/MCSN Cable modem and a high-capacity, high-bandwidth, integrated storage subsystem.

30. A video games system as claimed in any one of the proceeding claims, wherein the Game Servers consists of multiprocessor system, coupled with disk arrays which is operable to transmit video games data over a digital transmission channel or a non transmission channel to a users

terminal that may be connected to a Cable, Satellite or Terrestrial TV network.

31. A video games system as claimed in any one of the proceeding claims, wherein the Game Servers consists of network interfaces based on Gigabyte System Network (GSN) to Fiber Channel (FC) bridge which is operable to connect the Games Server to a Cable, Satellite or Terrestrial TV network.

32. A video games system as claimed in any one of the proceeding claims, wherein the Game Server consists of multiple network interface input/outputs (I/O) which is operable to connect to a TV network backbone which can provide video game data over the network at various speeds of gigabytes per second between a number of industry standard communication fabrics such as Gigabit Ethernet and Asynchronous Transfer Mode (ATM).

33. A video games system as claimed in any one of the proceeding claims, wherein a user's terminal comprising of a Set top box, Games Console or PC may access the games system through a polarity of networking standards including but not limited to HFC cable, DSL, high-bandwidth fiber trunk, and/or IP-based networking.

34. A video games system as claimed in any one of the proceeding claims, wherein a video game may be provided by a Game Server using a variety of network interface controllers including integrated QAM 64 and QAM 256 modulators with or without integrated frequency upconverters, DVB-ASI, ATM/OC3c, 10/100BaseT, and Gigabit Ethernet.

35. A video games system as claimed in any one of the proceeding claims, wherein data streams that are provided by Games Server to subscriber may be constructed from data that may be retrieved from a QAM content servers, digital networks, satellite down/up links, Fast Ethernet, video decoders, and VHF/UHF signals.

36. A video games system as claimed in any one of the proceeding claims, wherein video and audio streams that are provided by Games Server to subscribers may be constructed from data that may be stored on disk drives, digital networks, satellite down/up links, Fast Ethernet, video decoders, and VHF/UHF signals.

37. A video games system as claimed in any one of the proceeding claims, wherein means are provided through a user interface whereby a user may trigger a game to download directly relating to video on digital transmission channel or Analogue Transmission Channel or non transmission channel to a Games Console, PC or Set top box via a modem or receiver.

38. A video games system as claimed in any one of the proceeding claims, wherein means are provided by the Games System for a user terminal through a video preview of a game provided on transmission channel on their digital TV to be prompted to download a game on to their Set top box, PC or Games Console by a user selection on a controller that then initiates the users terminal to retrieve a video game from a digital transmission channel or non transmission channel that is provided by a Games Server situated on the digital TV network.

39. A video games system as claimed in any one of the proceeding claims, wherein a video game may be downloaded from a digital transmission channel to a user's Games Console, PC or Set top box by pressing the a button on a controller or remote control that sends a signal is transmitted to the user's Games Console, PC or Set top box that in turn transmits signal for authentication to download a game from a digital transmission channel.

40. A video games system as claimed in any one of the proceeding claims, wherein a user that interactively selects to download a game from digital transmission channel or non transmission channel using a plurality of devices connected to the digital TV network including but not limited to a Games Console, PC or Set top box may be authenticated which causes a receiver to switch channels to correct program source for a video game which is transmitted to the user's Games Console, PC or Set top box via a digital transmission channel from a Games Server situated remotely on the digital TV network.

41. A video games system as claimed in any one of the proceeding claims, wherein a may user through a user terminal may responded to the video preview of a video game by pressing a button on their games pad which downloads a game from digital transmission channel or non transmission channel using a plurality of devices connected to the digital TV network including but not limited to a Games Console, PC or Set top box may be authenticated which causes a receiver to switch channels to correct program source for a video game which is transmitted to the user's Games Console, PC or Set top box via a digital transmission channel from a Games Server situated remotely on the digital TV network.

42. A video games system as claimed in any one of the proceeding claims, wherein a user through a terminal connected to a digital TV network may access and download games through a user interface provided over a digital transmission channel or non transmission channel and rendered on the user's terminal a graphical user interface.

43. A video games system as claimed in any one of the proceeding claims, wherein a user through a terminal that may include a Games Console, PC or Set top box connected to a digital TV network may access and download games through a user interface provided over a digital

transmission channel or non transmission channel from a Games Server and rendered on the user's terminal.

44. A video games system as claimed in any one of the proceeding claims, wherein a user through a terminal connected to a digital TV network may access and download games through a user interface provided over a TV channel or non transmission channel achieved through transmitting HTML/Java data in a digital transmission channel or in-band Forward Path, or an out-of-band forward data channel (FDC) to a subscribers Set top box, Games Console or PC.

45. A video games system as claimed in any one of the proceeding claims, wherein a user terminal that may comprise of a Games Console, PC or Set top box using a Middleware engine is operable to render the user interface (UI) using the HTML and Java objects provided by a Middleware or Proxy Server that may be used to select and download games provided in a digital transmission channel or in-band Forward Path, or an out-of-band forward data channel (FDC) by a Games Server.

46. A video games system as claimed in any one of the proceeding claims, wherein a user terminal that may comprise of a Games Console, PC or Set top box using a Middleware engine is operable to render the user interface (UI) using the HTML and Java objects realised within the Games Console, PC or Set top box memory resources may be used to select and download games provided in a digital transmission channel or in-band Forward Path, or an out-of-band forward data channel (FDC) by a Games Server.

47. A video games system as claimed in any one of the proceeding claims, wherein a video previews of games available may be provided within the user interface rendered by a user terminal that may comprise of a Games Console, PC or Set top box using a Middleware engine is operable to render the user interface (UI) using the HTML and Java objects that may be used to select and download games provided in a digital transmission channel or in-band Forward Path, or an out-of-band forward data channel (FDC) by a Games Server.

48. A video games system as claimed in any one of the proceeding claims, wherein means are provided through software applications provided on user terminal that may consist of a Games Console, Set top box or PC a user is able to select a game using their remote or games pad, which triggers a receiver in Set top box, Games Console or PC to switch channels to correct Program Identity (PID) relating to the game selected by the user which is downloaded from a digital transmission channel or non transmission channel to a user's Games Console, PC or Set top box.

49. A video games system as claimed in any one of the proceeding claims, wherein the method of selecting a correct packet ID (PID) is selected through a resident application which is operable retrieve the data from a FDC or DTC and store a video game on to the memory of a Set top box, Games Console or PC from which the game may be rendered and played locally on a user's terminal.

50. A video games system as claimed in any one of the proceeding claims, wherein means may be provided whereby games are provided continuously via a digital transmission channel (DTC) or forward data channel (FDC) through configuring a Game Server to continuously retrieve and output game data over multiple MPEG-2 streams aggregated into a single DTC or FDC through interfacing with the QAM Modulator or QPSK Modulator enabling multiple users to simultaneously download or retrieve video games from a DTC or FDC on to the memory Games Console, PC or STB at anytime.

51. A video games system as claimed in any one of the proceeding claims, wherein game data required by a subscriber may be stored on the Games server and transmitted continuously to all subscribers tuned into a specific digital transmission channel or on demand to specific user via a non transmission channel or forward data channel to a Games Console, Set top box or PC that is connected to a digital TV network.

52. A video games system as claimed in any one of the proceeding claims, wherein a separate incoming QAM signal or ATC source which a user terminal is operable to select through an RF tuner that has a defined bandwidth of 6 to 8MHz that may be utilised to provide games data simultaneously to users Games Consoles, PCs or Set top boxes that are tuned into channel or QAM signal.

53. A video games system as claimed in any one of the proceeding claims, wherein a Games Server may be configured to broadcast game data to multiple users over the Internet using a technique referred to as multicasting over IP whereby games may be accessed from a Games Server by a user's terminal that may consist of a Games Console, PC or Set top box.

54. A video games system as claimed in any one of the proceeding claims, wherein a Game Server maybe interfaced with the QPSK Modulator at the Headend or Hub, whereby games maybe transmitted continuously or on demand over a Forward Data Channel (FDC) from which games maybe downloaded onto a Games Console, PC or STB.

55. A video games system as claimed in any one of the proceeding claims, wherein a process of selecting and downloading a game from a FDC may be initiated by a request for game that may formed by the Game Server or a number of alternative user devices, including STB, Games Console or PC.

56. A video games system as claimed in any one of the proceeding claims, wherein requests for video games from the Games Server may be formed by a Set top box, Games Console or PC may be provided to Games Server via the Reverse Data Channel (RDC).

57. A video games system as claimed in any one of the proceeding claims, wherein a Cable Modem, Satellite Modem or Terrestrial Modem connected to a users Set top box, Games Console or PC using QPSK modulation is operable to provide a Reverse Data Channel in which requests for video games may be transmitted upstream to a Game Server situated remotely on a digital TV network.

58. A video games system as claimed in any one of the proceeding claims, wherein a request may be initiated through a resident application on a Set top box, PC or Games Console for a specific game that is provided by a resident application relating to a video preview of a game on a DTC which has a specific Channel ID, Service ID that is used to define the game requested and Packet ID within an MPEG-2 Transport stream or a URL provided by the Game Server used by the resident application to identify the correct Transport Stream relating to game requested that is then retrieved and stored on the users Games Console, PC or Set top box. .

59. A video games system as claimed in any one of the proceeding claims, wherein a request may be initiated by the Game Server whereby game data is retrieved from a disk array and provided within an out-of-band FDC continuously thereby not requiring a request to constructed by a resident application on a user Set top box, PC or Games Console to download a video game transmitted in a out-of band forward data channel or in-band digital transmission channel.

60. A video games system as claimed in any one of the proceeding claims, wherein a user's terminal that may comprise of a plurality of devices including but not limited to a Set top box, Games Console or PC is operable to interpret requests for a game data from a user's interaction with a Games Pad or controller which initiates a video game to be received from either an in-band DTC or out-of-band FDC signal and loaded into the memory on the device in order for the game to be realised and played.

61. A video games system as claimed in any one of the proceeding claims, wherein a method of providing video games consists of retrieving game data from the Games Servers Storage Subsystem which is then output through a network interface to an MPEG encoder which is operable to encode the data into MPEG 2 transport streams which may be combined with video and audio streams which are then multiplexed into a single in-band Digital Transmission Channel DTC or an out-of-band Forward Data Channel and provided as a constant data bit stream to a user's Games Console, PC or Set top box.

62. A video games system as claimed in any one of the proceeding claims, wherein a method of providing video games consists of retrieving game data from the Games Servers Storage Subsystem which is then output through a 256 QAM Waveform that is modulated by a QAM Modulator typically at bandwidth of 6MHz providing a total throughput of 36.5Mbps providing video games to users Games Consoles, PCs or Set top boxes.

63. A video games system as claimed in any one of the proceeding claims, wherein method of providing video games consists of retrieving game data from the Games Servers Storage Subsystem which is then output through a forward data channel as an out-of-band QPSK Waveform that is modulated by a QPSK Modulator typically at bandwidth of 1MHz providing a total throughput of 6Mbps for transmitting video games to a users terminal that may comprise of a Games Console, PC or Set top box.

64. A video games system as claimed in any one of the proceeding claims, wherein games data provided by the Games Server within a digital transmission channel may be stored on multiple hard discs, Disk Arrays, Optical Disc Drives, DVD Drives and hot swappable removable disks.

65. A video games system as claimed in any one of the proceeding claims, wherein games data provided by Games Server within digital transmission may be retrieved from data that may be stored on QAM content servers, digital networks, satellite down/up links, Fast Ethernet, video decoders, and VHF/UHF signals.

66. A video games system as claimed in any one of the proceeding claims, wherein video and audio streams that are provided by Games Server to subscribers may be constructed from data that may be stored on disk drives, digital networks, satellite down/up links, Fast Ethernet, video decoders, and VHF/UHF signals.

67. A video games system as claimed in any one of the proceeding claims, wherein a native application coded in C or C++ is operable to retrieve data from the Game Server sub storage system which is output directly to an MPEG encoder that is operable to encode the data into MPEG-2 Streams which may then be transmitted within an in-band DTC or out-of-band FDC signal to subscribers Set top box, Games Consoles or PC.

68. A video games system as claimed in any one of the proceeding claims, wherein a application resident on the subscribers Set top box, PC or Games Console is operable to interpret the data and render a game that is realised within the RAM.

69. A video games system as claimed in any one of the proceeding claims, wherein the Game Server may also be directly interfaced with the QAM modulator and QPSK modulator through GSN or Fiber based I/O Network interfaces.

70. A video games system as claimed in any one of the proceeding claims, wherein the Game Server may support variable channelisation and supports 4, 16, 32, 64, 128 and 256-QAM in which these modulations provide various different bit rates, which may be used to support various Cable, Terrestrial or Satellite TV operator's bandwidth and spectrum availability to provide video games to user's Set top boxes, Games Consoles or PCs.

71. A video games system as claimed in any one of the proceeding claims, wherein data, audio and video output from the Games Server is digitally encoded by an MPEG encoder and provided as a constant bit rate data, audio and video streams which are multiplexed and modulated into in-band QAM signal or out-of-band QPSK signal and transmitted to subscribers STBs, Games Consoles or PCs.

72. A video games system as claimed in any one of the proceeding claims, wherein a Games Server may contain several MPEG video pumps that are operable to provide an aggregate MPEG-2 transport stream throughput of over 800 MB/s per second per encoder whereby up to 20 MPEG-2 data transport streams may be aggregated into one 256-QAM Digital Transmission channel, which may be provided continuously over a Broadcast File System (BFS) achieved through combining multiple MPEG-2 data transport streams in to a signal 256-QAM Waveform that may be used to broadcast video games to users terminals including but not limited to Set top boxes, Games Consoles and PC's over a Cable TV network, Satellite link or Terrestrial UHF transmission.

73. A video games system as claimed in any one of the proceeding claims, wherein whereby up to 200 or more MPEG-2 transport streams each containing a different game may be provided continuously by a Games Server as date stream over multiple transmission paths including in-band QAM or out-of-band QPSK signals.

74. A video games system as claimed in any one of the proceeding claims, wherein the transmission path used to transmit game data to subscribers Set top box, Games Console or PC may include a multiple of communication paths including Ka-band, Ku-Band, C-band, L-band, N-band satellite links or UHF/VHF terrestrial signals.

75. A video games system as claimed in any one of the proceeding claims, wherein games that are stored on the Game Server Storage Subsystem may be transmitted over a variety of links to a users Games Console, PC or STB including Radio Frequency Links (UHF/VHF), Digital Broadcast Satellite Links, Cable TV Networks Transmissions,

Standard Terrestrial Communication Links (PDH, SDH), Microwave Line of Sight (LoS) Links (wireless), Digital Subscriber Links (ADSL family) and Packet / Cell Links (ATM, IP, IPv6, Ethernet).

76. A video games system as claimed in any one of the proceeding claims, wherein data transmission may be provided over a simplex or full duplex using an interaction channel for the return path to a Games Server.

77. A video games system as claimed in any one of the proceeding claims, wherein may be transmitted by a Games Server using Unicast point-to-point, Multicast or broadcast whereby video games are received by all user terminal receivers receiving the assigned PID and rendered locally on a Games Console, PC or Set top box.

78. A video games system as claimed in any one of the proceeding claims, wherein various methods may used by a Games Server to provides video game data within a DTC or FDC to a users Games Console, PC or Set top box which includes of Data Piping, Data Streaming, Data Carousels or Object Carousels.

79. A video games system as claimed in any one of the proceeding claims, wherein a method Data Piping is used by the Games Server to deliver discrete pieces of data using containers to the destination provided by the Games Server over a in-band digital transmission channel or out-of-band forward data channel to a user's Games Console, PC or Set top box..

80. A video games system as claimed in any one of the proceeding claims, wherein Data Streaming is a method used by the Game Server to provide games data to a users Games Console, PC or Set top box which takes the form of a continuous stream that is carried in an asynchronous PES.

81. A video games system as claimed in any one of the proceeding claims, wherein a Data Carousels is a method is used by the Game Server for assembling game data sets into a buffer, which are played-out cyclic manner or periodic transmission.

82. A video games system as claimed in any one of the proceeding claims, wherein games provided by the Games Server may be transmitted using fixed sized DSM-CC sections to a user's Games Console, Set top box or PC operable to receive digital transmissions.

83. A video games system as claimed in any one of the proceeding claims, wherein a method that is used by the Game Server is Object Carousel which is used to broadcast games data to a users Games Console, PC or Set top box.

84. A video games system as claimed in any one of the proceeding claims, wherein a method that is used by the Game Server to provide video games is DVB Network Independent Protocol specification and may be used, to down-load data to a users Games Console, PC or Set top box.

85. A video games system as claimed in any one of the proceeding claims, wherein a method of using a Broadcast File System (BFS) for transporting game data repeatedly over a network to a user's Game Console, PC or Set top box is used by the Games Server without requiring the use of an Reverse Data Channel from the users Games Console, PC or Set top box to request data from the Game Server.

86. A video games system as claimed in any one of the proceeding claims, wherein transport protocols may be used to transmit game data from a Games Server over a network to a Set top box, Games console or PC includes using Schedule Transfer (ST), TCP/IP, RTSP and IP.

87. A video games system as claimed in any one of the proceeding claims, wherein users can begin to download a game at any point of the data cast regardless of when the user triggers the download data provided within the Broadcast File System that is transmitted via in-band QAM or out-of-band QPSK signals may be accessed through a data stream manager resident on the users Set top box, Games Consoles or PCs which is activated on a users request.

88. A video games system as claimed in any one of the proceeding claims, wherein means may be provided whereby a user is not required to download an entire game to play whereby through using the Broadcast File System a Games Console or PC are operable to access data just as they would from a CD or DVD whereby only the data required for the game level is loaded into the memory whereby the subscriber does not have to download the entire game onto a hard disc or Personal Video Recorder (PVR) to be played.

89. A video games system as claimed in any one of the proceeding claims, wherein a BFS acts as storage for all games each with a unique Packet ID identifiable within a unique MPEG-2 Stream that is provided continuously over a FDC or DTC which removes the necessity for storage capacity on the users device as all the game data may be stored and retrieved from within BFS, which is provided continuously over a DTC or FDC to a users device.

90. A video games system as claimed in any one of the proceeding claims, wherein various formats may be used by the Games Server to transport the game data including but not limited to MPEG-2, MPEG-4, DigiCipher II and Raw Transport Data (RTD).

91. A video games system as claimed in any one of the proceeding claims, wherein a subscriber's STB, Games Console or PC is operable to

retrieve raw data sent in MPEG-2 private section through transmitting data and video from a Games Server over the same transport stream.

92. A video games system as claimed in any one of the proceeding claims, wherein a resident applications within the users STB, Games Console or PC enables data provided with MPEG-2 private data stream to be interpreted and a game to be rendered on the users TV screen.

93. A video games system as claimed in any one of the proceeding claims, wherein a resident application enables a user to retrieve data within the MPEG-2 transport stream that can be interpreted by a Games Console, STB or PC and a game may be loaded on screen.

94. A video games system as claimed in any one of the proceeding claims, wherein a stream manager a resident application is operable to tune the user's device into the correct frequency and PID of the game requested by the user which enables a game to be retrieved from a transmission signal.

95. A video games system as claimed in any one of the proceeding claims, wherein software drivers may be provided by a Games Server to Games Consoles, PC or STB through a digital transmission channel (DTC).

96. A video games system as claimed in any one of the proceeding claims, wherein user may accesses a digital transmission channel the necessary software drivers to play a game may be provided directly to viewers Games Console, PC or STB which may be provided over a DTC or FDC and stored as resident applications.

97. A video games system as claimed in any one of the proceeding claims, wherein means may be provided whereby a user can select and download drivers from GUI which may be specific to a device that may be connected to viewers Games Console, PC or Set top box and may be used to play a game using an Infrared or USB Games Pad.

98. A video games system as claimed in any one of the proceeding claims, wherein means may be provided through a GUI whereby a user can select and download multiple games at same time on to a Games Console, PC or Set top box whereby data may be stored on a hard disc, personnel video recorder (PVR) or a secondary memory device.

99. A video games system as claimed in any one of the proceeding claims, wherein multiple games which may be provided by a Games Server over a QAM or QPSK signal to a users Set top box, Games Console or PC.

100. A video games system as claimed in any one of the proceeding claims, wherein a Command Server is operable to vary the rate of the transport

streams in relation to size of game whereby the bit rate throughput may be adjusted from 512 Kbps up to 56 Mbps per game.

101. A video games system as claimed in any one of the proceeding claims, wherein a video game may saved within the flash memory of a Set top box as a resident application from which the subscriber may select and load a game from the point the game was saved.

102. A video games system as claimed in any one of the proceeding claims, wherein a resident application on the Set top box is operable to save and load saved games stored on the USB memory card.

103. A video games system as claimed in any one of the proceeding claims, wherein through a resident application on the Set top box a video game may saved on a user's a Smart card that is connected to the Set top box.

104. A video games system as claimed in any one of the proceeding claims, wherein means may be provided through a resident application on the STB would enable a subscriber to save and load saved games stored on hard disc or a Personal Video Recorder (PVR).

105. A video games system as claimed in any one of the proceeding claims, wherein a subscriber may save a game played on a STB on a Games Server which would be held remotely on a database.

Server Software
Architecture

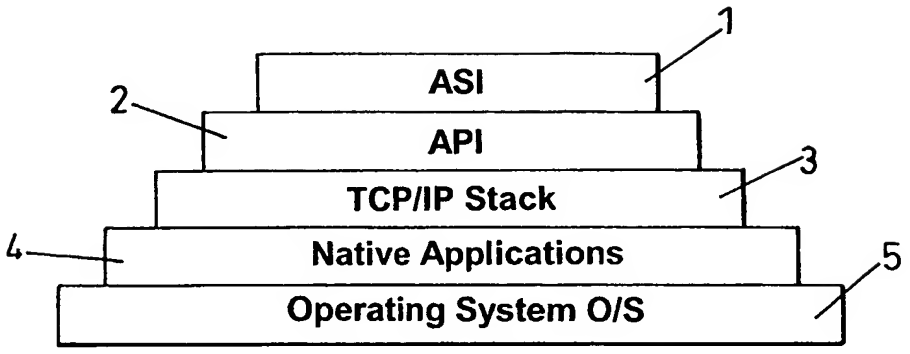


Fig. 1

Client Software
Architecture

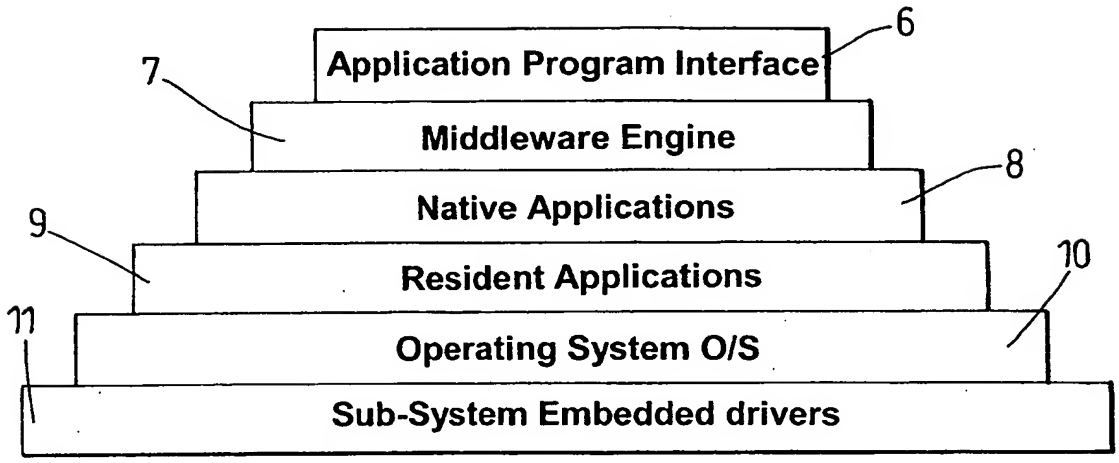
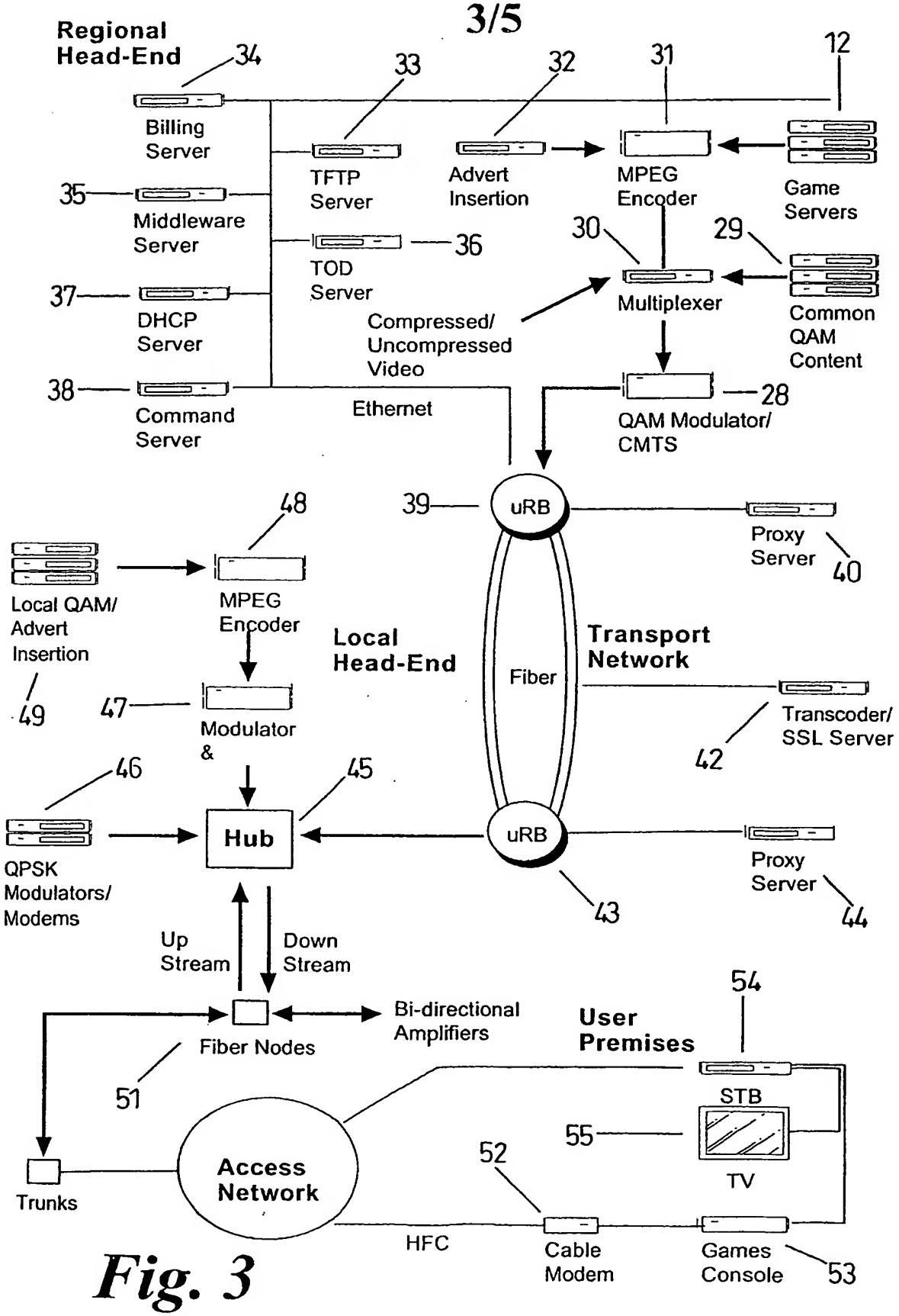


Fig. 2


Regional Head-End
34
33
32
31
12
Billing Server
TFTP Server
Advert Insertion
MPEG Encoder
Game Servers
35
Middleware Server
36
TOD Server
30
29
Multiplexer
Common QAM Content
37
DHCP Server
Compressed/ Uncompressed Video
38
Command Server
Ethernet
28
QAM Modulator/ CMTS
39
uRB
48
Proxy Server
40
Local QAM/ Advert Insertion
MPEG Encoder
Local Head-End
Fiber
Transport Network
49
47
Modulator &
Transcoder/ SSL Server
42
46
45
Hub
uRB
QPSK Modulators/ Modems
Proxy Server
44
43
Up Stream
Down Stream
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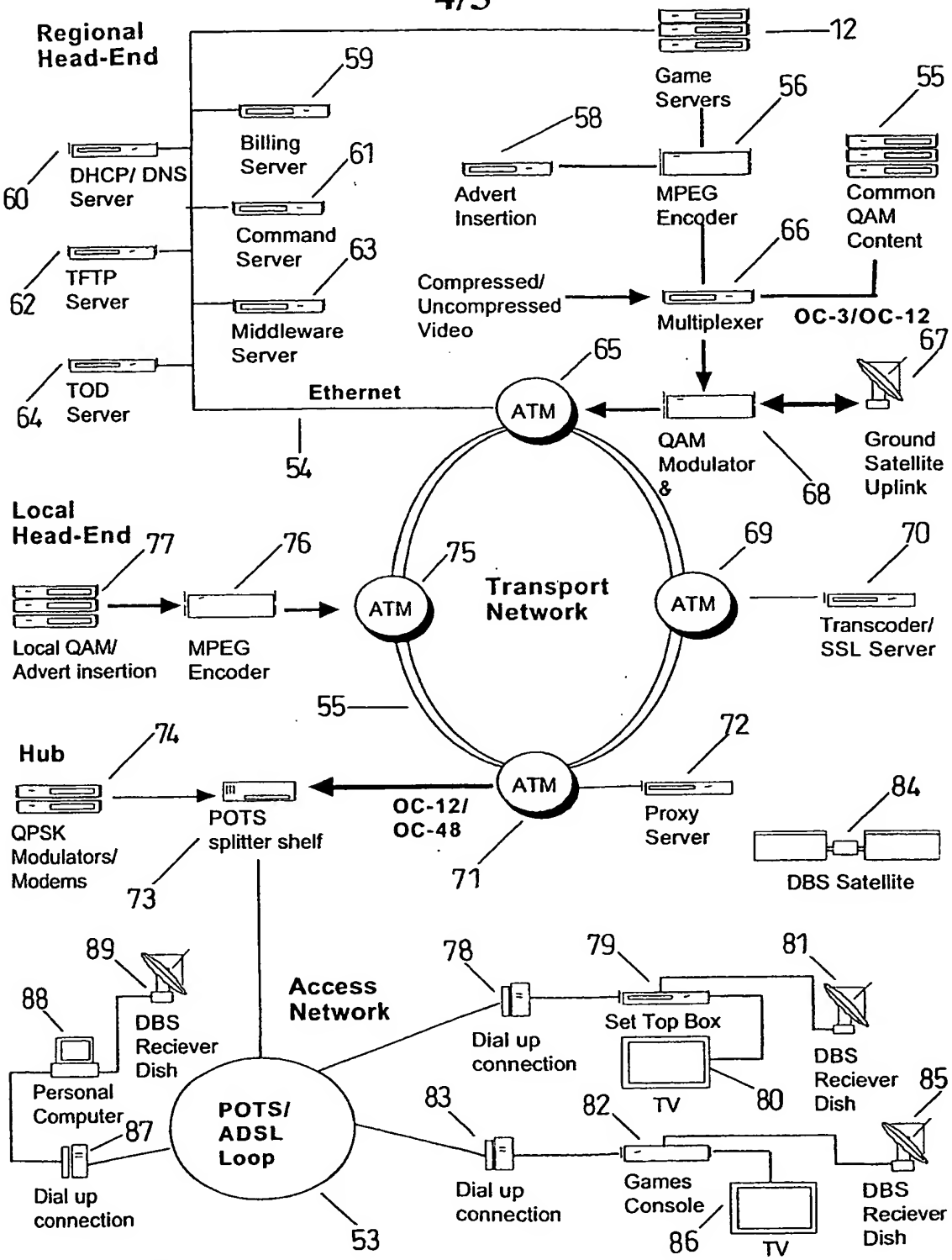
Bi-directional Amplifiers
User Premises
Fiber Nodes
51
STB
55
52
Access Network
TV
Trunks
HFC
Cable Modem
Games Console
53

Fig. 3


Regional Head-End
12
Game Servers
59
Billing Server
58
56
55
Advert Insertion
MPEG Encoder
Common QAM Content
60
DHCP/ DNS Server
61
Command Server
66
Compressed/ Uncompressed Video
Multiplexer
OC-3/OC-12
62
TFTP Server
63
Middleware Server
67
65
64
TOD Server
Ethernet
ATM
QAM Modulator &
Ground Satellite Uplink
54
68
Local Head-End
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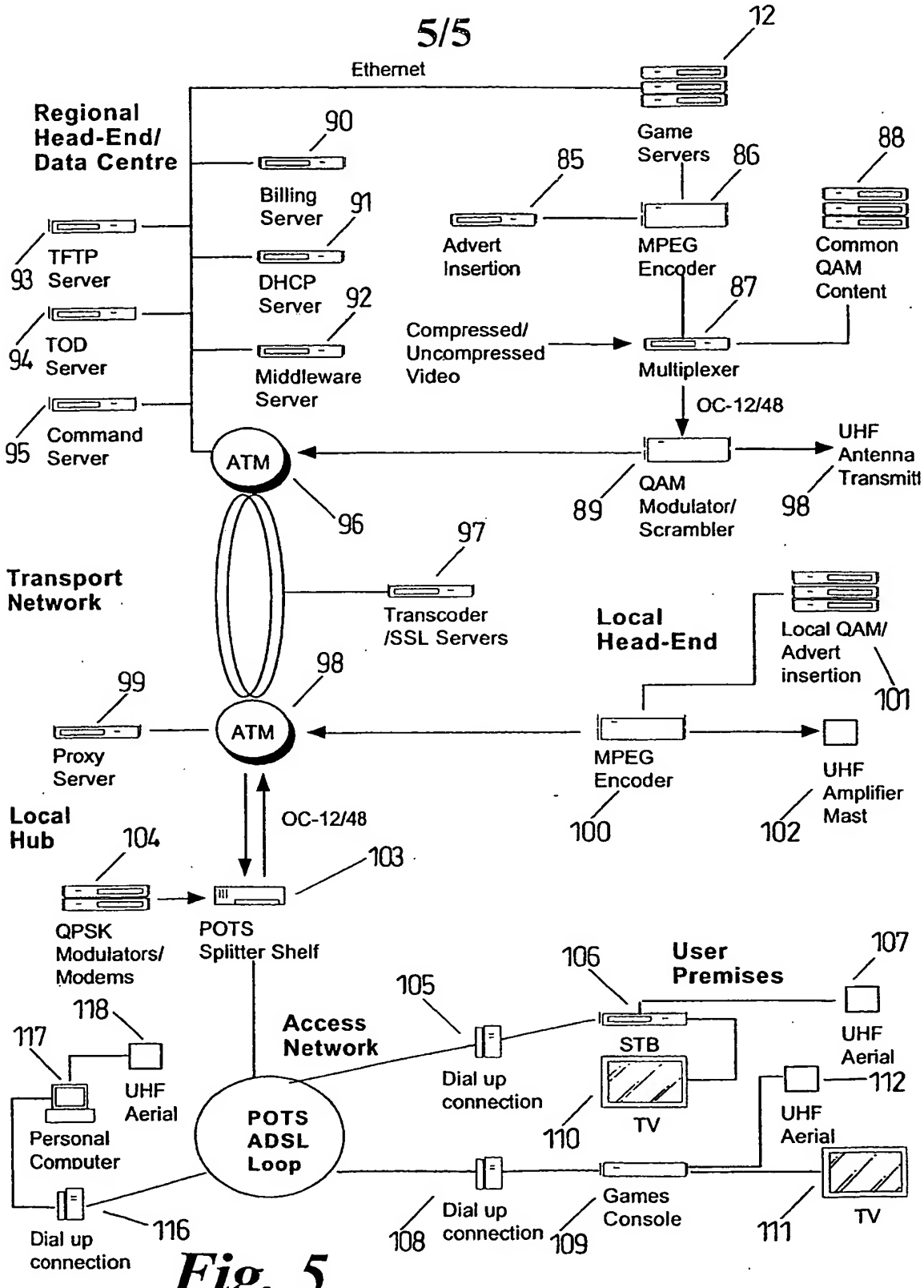
76
75
69
70
ATM
Transport Network
ATM
Local QAM/ Advert insertion
MPEG Encoder
Transcoder/ SSL Server
55
Hub
74
72
ATM
QPSK Modulators/ Modems
POTS splitter shelf
OC-12/ OC-48
Proxy Server
84
73
71
DBS Satellite
89
78
79
81
Access Network
88
DBS Reciever Dish
Dial up connection
Set Top Box
DBS Reciever Dish
Personal Computer
83
82
85
87
POTS/ ADSL Loop
TV
80
Dial up connection
Dial up connection
Games Console
DBS Reciever Dish
53
86
TV

Fig. 4


12
Ethernet
Regional Head-End/ Data Centre
90
Billing Server
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DHCP Server
92
Middleware Server
93 TFTP Server
94 TOD Server
95 Command Server
85
Advert Insertion
Game Servers
86
MPEG Encoder
88
Common QAM Content
Compressed/ Uncompressed Video
87
Multiplexer
OC-12/48
ATM
96
89 QAM Modulator/ Scrambler
98 UHF Antenna Transmitt
Transport Network
97
Transcoder /SSL Servers
Local Head-End
Local QAM/ Advert insertion
101
99
98
ATM
Proxy Server
MPEG Encoder
100
UHF Amplifier Mast
102
Local Hub
OC-12/48
104
103
QPSK Modulators/ Modems
POTS Splitter Shelf
106
User Premises
107
105
118
117
Access Network
UHF Aerial
Dial up connection
STB
UHF Aerial
112
Personal Computer
POTS ADSL Loop
110
TV
UHF Aerial
Dial up connection
Games Console
TV
116
108
109
111

Fig. 5

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